THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

Volume 19 SEPTEMBER, 1940 Number 9

For story, see page 344

EDWARD RAY WEIDLEIN

Instruments Can Help Climb Production Peaks

Production men can short-cut to the correct answer to many a problem by making use of the readily available results of our wide experience in the use of instruments.

We have measured some or all of the conditions in most measurable types of industrial process, and in many we've carried through to automatic control.

We supply controls for new, high-efficiency units, where the utmost in instrument performance is specified.

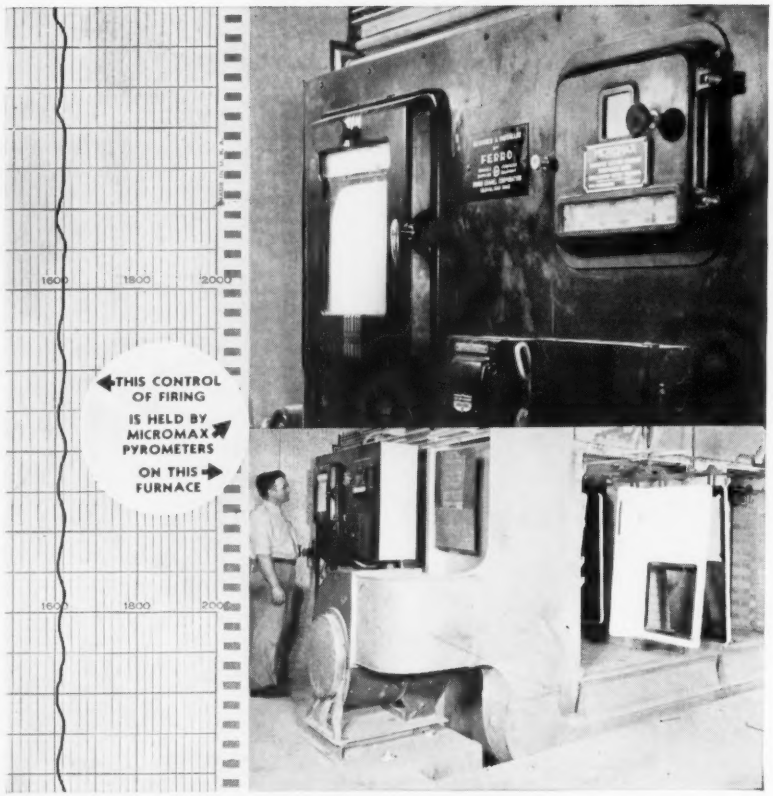
And many a piece of "marginal" equipment, pressed back into service to meet a peak, is giving better results than ever before, because its operator has L&N instruments to help him.

Hard service and minimum care are two conditions which we definitely expect for our instruments; we know they will be required to produce, and we make them correspondingly dependable. They're built not only for everyday conditions, but to meet emergencies.

Below we list some general literature available on request, and if you face a problem in instrumentation you're invited to send for them or simply give us the details. Our staff of engineers will be glad to offer you all possible assistance toward a prompt, sure solution.

Fully-automatic temperature control which can be applied to any industrial furnace and which is micro-responsive in holding the set temperature is described in Catalog N-00A, "Micromax Electric Control." This catalog will be sent on request.

Production troubles are easier to handle, and furnace linings last longer, when the furnace pressure of kilns, glass tanks, lehrs, etc., is held constant by an L&N Controller. It offsets any changes due to wind, outside temperature, etc.; can be reset instantly; is sensitive, simple and strong. See Bulletin N-01A-600.



BETTER ENAMELING

With help of Micromax Pyrometers

The job of handling the fuel valves on an enameling furnace, so as to hold a steady heat for firing, is left entirely to Micromax Pyrometers in the plant of Geo. D. Roper Corp., stove manufacturers, Rockford, Ill. Their engineers make full use of the instrument's micro-responsiveness to secure close control with simple, dependable equipment.

The most recent of their furnaces is a Ferro-Enamel radiant-tube continuous unit, fired with gas through a pair of diaphragm valves. Using only high-low settings for the valve, the promptness and accuracy of the Micromax are such that temperature is held to within ±10 F of the optimum. In the case shown, this is 1610 F, but it can be changed by simply moving a dial.

There's a Micromax or other L&N pyrometer for every ceramic-plant need. Broadside N-33, describing them, will be sent on request.

LEEDS & NORTHRUP COMPANY, 4990 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl ad N-0720(2)

THE BULLETIN OF THE AMERICAN CERAMIC SOCIETY

Volume 19 — **Contents for September, 1940** — **Number 9**

PAPERS

Some Factors Affecting Plaster Mold Life—M. C. Dailey and B. Nies 323

Methods Used to Reduce Surface Lines on Glass—R. L. Shute 329

Development of a Laboratory Continuous Kiln—C. H. Commons, Jr., and E. E. Kunzman 331

Stoker Firing of Kilns—J. E. Martin 334

High-Temperature Gas-Fired Test Furnace—C. L. Thompson and H. G. Wilcox 336

Notes on Refractories at Noranda Smelter—W. B. Boggs 338

The Clay Deposits of California—W. F. Dietrich 340

The Cincinnati Pottery Club—Clara Chipman Newton 345

Advertisers' Index **6**

Buyers' Guide **12, 18, 20, 22**

INDEX TO CERAMIC HISTORY, ACTIVITIES, NOTES

American Ceramic Society, Fellowship Rules revised, p. 357.
American Electroplaters' Society, 1940 Proctor Memorial Award to C. A. Zapffe and C. L. Faust, p. 360.
Art, National Ceramic Exhibition, ninth, p. 360.
Art Division, members at Blue Ridge art conference, p. 354.
Autumn Meeting programs for Glass, Refractories, Materials and Equipment and White Wares Divisions, p. 354.
Awards, Proctor Memorial, for 1940, American Electroplaters' Society, to C. A. Zapffe and C. L. Faust, p. 360.

Battelle Memorial Institute, Zapffe, C. A., and Faust, C. L., 1940 Proctor Memorial Award of American Electroplaters' Society, p. 360.
Blue Ridge Annual Art Conference, sixth, p. 354.

Ceramic history, Cincinnati Pottery Club, p. 345; membership record (table), p. 348.
Porcelain League of Cincinnati, p. 351.
Weidlein, E. R., p. 344.
Ceramic schools, N. Y. State College of Ceramics, Electro Refractories and Alloys Corp., Fellowship, p. 358.
West Virginia Univ. ceramic extension course at Newell, p. 358.
Chicago Section, Sept. meeting, p. 355.
Cincinnati Porcelain League, history, p. 351.
Cincinnati Pottery Club, history, p. 345; membership record (table), p. 348.
and Porcelain League gifts to The Society, photo, p. 353.
Committees, Institute of Ceramic Engineers, p. 357.

Divisions, Autumn Meeting programs, p. 354.

Electro Refractories and Alloys Corp. Fellowship, p. 358.
Exhibits in Society office, Cincinnati Pottery Club and Porcelain League, p. 353.

Fellows, American Ceramic Society, Rules revised, p. 357.
Fellowship, Electro Refractories and Alloys Corp., at N. Y. State College of Ceramics, p. 358.

Glass Division, Autumn Meeting program, p. 354.
Glass exhibit at Department of Commerce, p. 360
new designs in glassware, p. 360.

Homer Laughlin China Co., sponsors of ceramic extension course, p. 358

Institute of Ceramic Engineers, committees, p. 357.

Local Sections, Chicago, Sept. meeting, p. 355.

Materials and Equipment Division, Autumn Meeting program, p. 354.
Members, Membership Workers' Record for July and Aug., p. 357.
New, for Aug., p. 357.
Paid Membership Record, p. 356.
Roster Changes for July and Aug., p. 356.
National Ceramic Exhibition, ninth, p. 359.
Necrology, Long, R. N., biog. and photo, p. 358.
Smith, M. A., biog., p. 358.
Newton, C. C., Cincinnati Pottery Club, p. 345.

Pence, F. K., at Univ. of Texas, p. 358.
Photographs, ceramic art class at Blue Ridge, p. 355.
Cincinnati Porcelain League, members, p. 352.
Cincinnati Pottery Club: anniversary exhibits, pp. 346, 349–50; members at tenth anniversary celebration, p. 351.
Cincinnati Pottery Club and Porcelain League gifts to The Society, p. 353.
Faust, C. L., p. 360.
Long, R. N., p. 358.
Schirer, Edward, modeling terra cotta by coil method, p. 355.
Schirer, Mary, throwing on kick wheel, p. 355.
Smith, Kenneth, tooling thrown vase, p. 354.
Weidlein, E. R., Sept. cover.
West Virginia Univ. ceramic extension course groups, p. 359.
Zapffe, C. A., p. 360.
Pottery course at Blue Ridge, p. 354.

Refractories Division, Autumn Meeting program, p. 354.

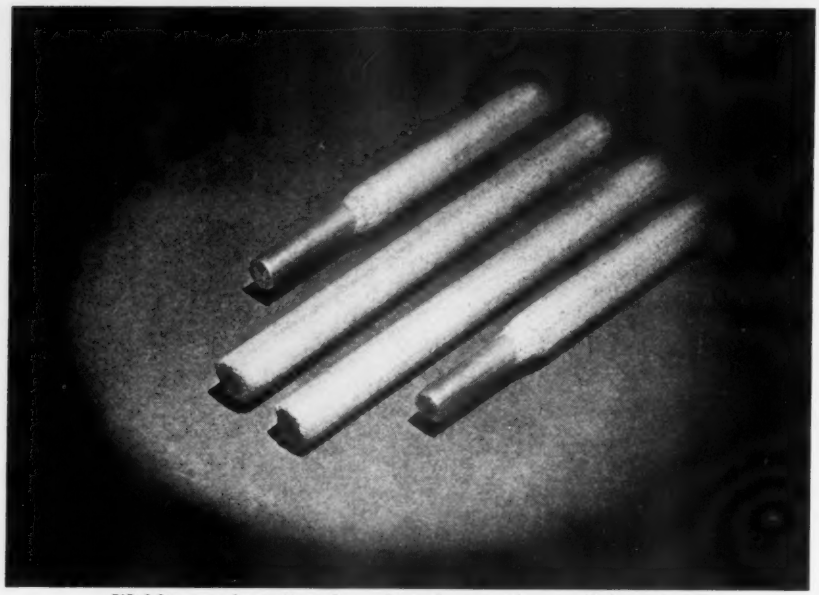
Weidlein, E. R., photo, Sept. cover, biog., p. 344.
West Virginia Univ. extension course at Newell, p. 358.
White Wares Division, Autumn Meeting program, p. 354.

Publication Office: 20th & Northampton Sts., Easton, Pa.
Editorial, Executive, and Advertising Offices: 2525 N. High St., Columbus, Ohio.
Committee on Publications: J. D. SULLIVAN, *Chairman;* E. E. MARBAKER, J. B. AUSTIN, A. N. FINN, ROSS C. PURDY.

Entered as second-class matter at the post office at Easton, Pa., under the act of March 3, 1879. Published monthly.
Subscription $1.50 a year. Single numbers twenty-five cents.
(Foreign and Canadian postage, 50¢ additional on subscriptions)

(Copyright 1940, American Ceramic Society, Inc.)

Lancaster



Welding rod coating formulas of mineral or cellulose types are developed to highest quality with the "Lancaster" Mixer.

Lancaster Mixers

OFFER SCIENTIFICALLY DEPENDABLE MIXING

Designed to provide scientific control over the movement of all batch ingredients, "Lancaster" Mixers obtain results with difficult formulas that are new to the art of industrial mixing.

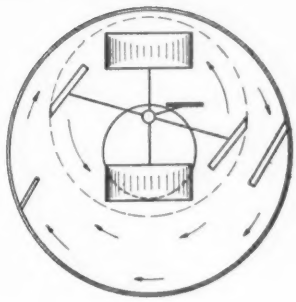
With welding rod coatings, for example, the "Lancaster" demonstrates superiority in the development of a full range of mineral or cellulose fluxes. The batch ingredients are uniformly distributed and accurately blended. Less heat is generated by the mixing action, avoiding hard, dry spots. The combined mixing-mulling action kneads the formula to proper plasticity. There are no "dead-spots" established thereby assuring uniform development of the entire batch. Less time is required to complete the mixing action, while low power and maintenance costs provide the kind of production economies which modern processing requires.

The "Lancaster" is a modern mixer for the modern plant. Complete information furnished without obligation, upon request. Write for copy of descriptive Bulletin 70 today.

LANCASTER IRON WORKS, INC.
BRICK MACHINERY DIVISION
LANCASTER, PENNA., U. S. A.

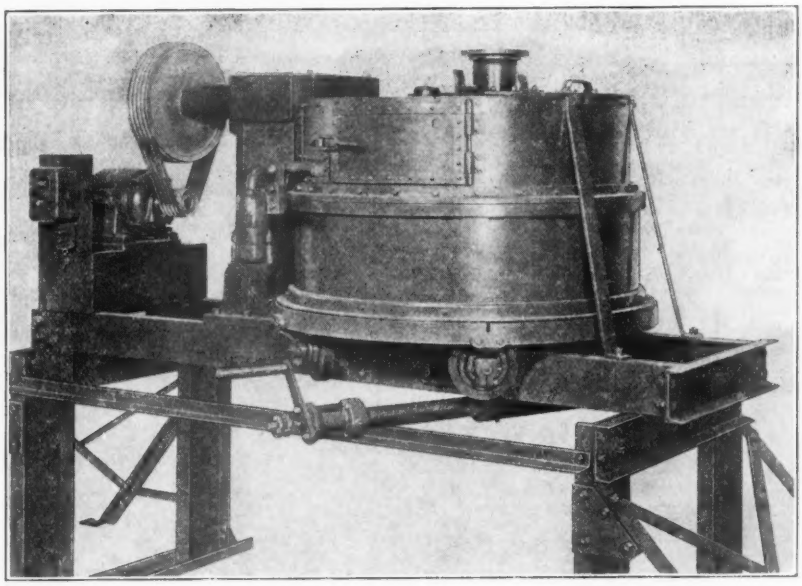
Lancaster

The "Lancaster" Mixing System is scientific. All batch ingredients are intensively processed many times during the mixing cycle, enabling development of simple or difficult formulas to the highest degree.



The mixing pan rotates in clockwise direction, conveying materials into a mixing area established off-center of the pan by counter-clockwise rotating mixing plows and mullers. The "whirl-pool" action thus created serves to distribute solids and liquid additions perfectly regardless of size, shape, or specific-gravity.

Any processing within the range of Dry, Damp, Soft-kneadable, Stiff-kneadable or Slurry consistencies merits the advantage of scientific "Lancaster" Mixing. Let us submit details on an application to your requirements.



The modern "Lancaster" Mixer, standard closed pan type.
A self-contained unit with the operating mechanism housed above the machine sills.

LANCASTER IRON WORKS, INC.
BRICK MACHINERY DIVISION
LANCASTER, PENNA., U. S. A.

Tunnel, Truck and Humidity Dryers
for—
Dry Pressed Electrical Porcelain
High Voltage Electrical Porcelain
Sanitary Porcelain
Floor Wall Tile
Abrasive Wheels
Glass Pots and Blocks
Refractory Bricks and Shapes
Also Stove Rooms and Mangles for General Dinnerware

PROCTOR & SCHWARTZ, INC.
The Largest Builders of Drying Machinery for Industry
Seventh Street & Tabor Road, Philadelphia, Pa.

PROVEN PERFORMANCE
THE WORLD'S PEMCO FINEST
THE PORCELAIN ENAMEL & MFG. CO.
Porcelain Enamels, Frits, Coloring Oxides and Supplies
PEMCO AND EASTERN AVES., BALTIMORE, MD.

CLAYS
English China and Ball
TALCS
for
HEATING ELEMENTS
CERAMIC BODIES
SAGGER USES

Ceramic Specialties Include
Whiting : Paris White : Magnesite
Cornwall Stone : Barium Carbonate
Zinc Oxide : Enameling Clays : Etc.

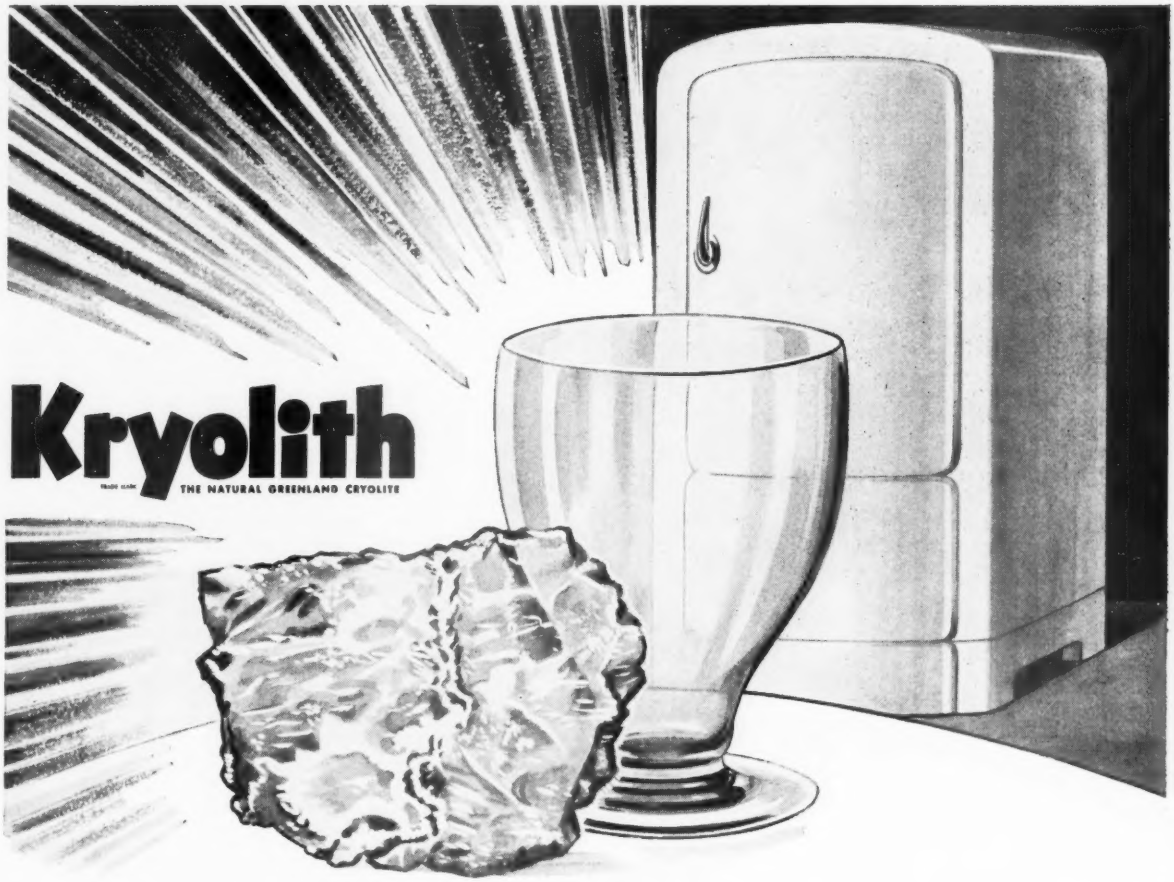
HAMMILL & GILLESPIE, INC.
Importers since 1848
225 Broadway New York

RESEARCH WORKERS
We offer every cooperation, assistance and counsel in developing new ideas applying to ceramic products of all kinds. . . Write or call at our office, where complete laboratory and technical facilities are available.
Distributors for the following Foote Minerals—Amblygonite, Antimony Sulphide, Barium Carbonate, Beryl, Chromite, Black Iron Oxide, Red Iron Oxide, Kaltan, Lithium Salts, Manganese Dioxide, Rutile, Fused Silica, Spodumene, Thorium Oxide, Zirconium Oxide.
Edgar Clays—Florida and Georgia—for Every Pottery Service. Wyodak Bentonite, Licensed under Kraus patents.

EDGAR PLASTIC KAOLIN CO.
Metuchen, N. J.
Over Half a Century of Satisfactory Service

FOR CLAY FILTRATION
use
METAKLOTH
(green)
Silvakloth
(black)
The oldest and best cupra-ammonium finish for
POTTERY FILTER FABRICS.
This finish gives the fabric a smooth, lustrous, metallic surface—no fibres to catch and break the clay cake as it comes away in one perfect piece—filters better and faster than untreated cloths—requires fewer washings and is easier to keep clean—more continuous operation of your press—lower labor costs and a larger and better product with the same machinery.
The fabric is mildew proofed—has an increased tensile strength—has a longer useful life.
This means larger profits for you.
Consult your bag manufacturer or write to,
Metakloth Company, Lodi, N. J.

ING-RICH
PORCELFRIT
"The Plant Tested Frit"
INGRAM-RICHARDSON MFG. CO. OF IND., INC.
FRANKFORT, INDIANA



. . . a mineral specimen that resulted in today's better glassware and enamels

About the year 1800, many European museums added an interesting new mineral to their collections. It came from Greenland, and it was known as "cryolite". It proved to be rich in fluorine, which was combined in it by Nature as a stable double fluoride.

Many uses were suggested for natural cryolite at first, some of them strange and wonderful . . . but the ceramic industry quickly realized that the real value of this mineral is as a fluoride flux and opacifier. Today it is known throughout the industry as Kryolith.

Its use has helped to make possible the superior qualities and steadily widening use of modern ceramic products. It is not only the strongest of fluxes, but its action is of long duration and increases with the furnace heat. It has also helped to produce today's beautiful new tints and shades in glassware. It always pays to be sure the frit you buy is made with the genuine natural material—Kryolith.

Pennsylvania Salt Manufacturing Company, Widener Building, Philadelphia, Pa. — New York • Chicago • St. Louis • Pittsburgh • Tacoma • Wyandotte.

PENNSYLVANIA SALT
MANUFACTURING COMPANY
Chemicals

ALPHABETICAL LIST OF ADVERTISERS

	Page
American Potash & Chemical Corporation	8
American Telephone & Telegraph Co.	26
Bausch & Lomb Optical Co.	15
Bethlehem Steel Company	21
Buyers' Guide	12, 18, 20, 22
*Celo Mines, Inc.	E353
Ceramic Color & Chemical Mfg. Company	21
Classified Advertisement	24
Corhart Refractories Company	10
Denver Fire Clay Co.	15
Du Pont de Nemours, E. I., & Co., Inc.	23
Edgar Plastic Kaolin Co.	4
Edward Orton, Jr., Ceramic Foundation	21
Foote Mineral Co.	14
Frazier-Simplex, Inc.	11
Government Ceramic Industries	14
Hammill & Gillespie, Inc.	4
Harshaw Chemical Co.	9
Hartford-Empire Company	8
Hommel, O., Company	13
Industrial Ceramic Products, Inc.	19
Ingram-Richardson Mfg. Co. of Indiana, Inc.	4
International Pulp Co.	19
Kaolin, Inc.	25
Kentucky Clay Mining Co.	13
Lancaster Iron Works, Inc.	2-3
Leeds & Northrup Co.	Inside Front Cover
Louthan Mfg. Co.	19
Maxson, Elwyn L.	17
McDanel Refractory Porcelain Company	8
Metakloth Co.	4
Metal & Thermit Corporation	Outside Back Cover
Montgomery Porcelain Products Co.	6
National Engineering Co.	7
Orton, Edward, Jr., Ceramic Foundation	21
Pacific Coast Borax Company	25
Paper Makers Importing Company	17
Pennsylvania Salt Mfg. Co.	5
Porcelain Enamel & Mfg. Company	4
Potters Supply Company	14
Proctor & Schwartz, Inc.	4
Professional Directory	19
Pyrometer Instrument Co.	24
Society of Glass Tech	13
Solvay Sales Corporation	8
Spinks, H. C., Clay Company	Inside Back Cover
Swindell-Dressler Corp.	19
United Clay Mines Corp.	8
Vitro Mfg. Company	6
Wilson, H. W., Company	25

* Page marked E appears in Editorial Section.

MONTGOMERY PORCELAIN PRODUCTS COMPANY

SPECIALIZING IN

Primary Protection Tubes for all makes of Pyrometers

★ CORUNDUM

★ REFRACTORY PORCELAIN

MONTGOMERY PORCELAIN PRODUCTS CO.
FRANKLIN OHIO

QUALITY COLORS for QUALITY WARE

Whether your requirements are large or small, we take the same painstaking care to serve you promptly and efficiently. Write us on any problem involving ceramic color.

★ Overglaze Colors ★ Vitreous Colors ★

★ Acid Resistant Colors ★ Oxide Colors ★

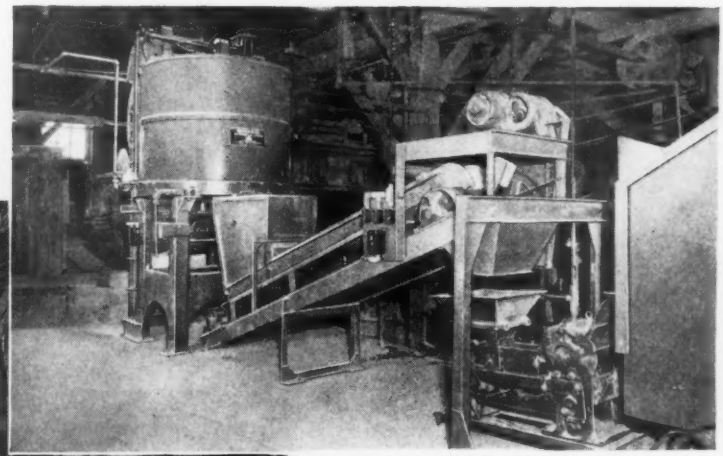
COLORS — CHEMICALS — SPECIALTIES

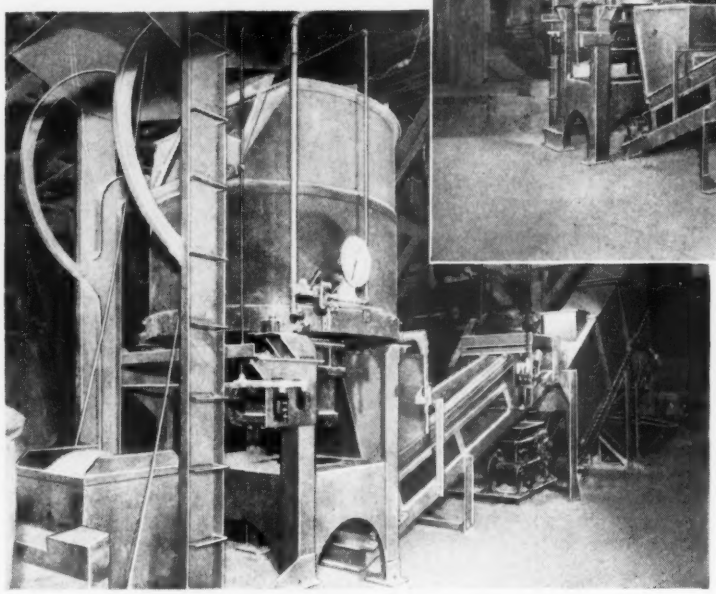
THE VITRO MANUFACTURING CO.
CORLISS STATION PITTSBURGH, PA.
16 California St., San Francisco, Calif.

"CONTROLLED MIXING"

SCORES AGAIN!

ON PORCELAIN BODIES





Two views, showing progressively the Simpson Straight Lift Bucket Loader, Simpson Mixer with water meter, Mill Conveyor to Micro-Pulverizer and Dust House Conveyor, housed throughout for dust suppression

FOUR (4) NEW INSTALLATIONS *of complete*

SIMPSON MIXER UNITS

BUILT IN TEN SIZES

HERE ARE THE REPORTED RESULTS FROM ONE OF THESE UNITS:

Eliminated 3 men in this department, working the rest only half the time, to take care of the equivalent production. The original force was 7 men. More will be eliminated, as they are still running a blunger for preparing pin body.

Use 30 H.P. as against 40 H.P. or more previously.

Can rework their scrap much better, as the heavy, wide-faced mullers break down the larger pieces so that they can be uniformly wetted, thus producing better material for pressing.

Savings in floor space, formerly occupied for storage of filter press cakes for aging and drying, has permitted moving press room adjacent to mixing department. This has eliminated a lot of handling of material and ware and afforded better inspection.

They are getting a much better grade of dust which runs more uniform from the standpoint of moisture as well as of mixing. This has made the pressing much easier and has reduced scrap.

AGAIN THE ADVANTAGE OF "CONTROLLED MIXING" IS DEMONSTRATED FACT—FLEXIBILITY, SIMPLICITY OF OPERATION AND OF CONTROL OF BODY MAKEDOWN—ASSURED UNIFORMITY AND OPERATING ECONOMY—INVESTIGATE NOW!

NATIONAL ENGINEERING COMPANY

549 W. Washington Blvd., Chicago, Illinois, U. S. A.

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland
For the British Possessions, excluding Canada and Australia—August's Limited, Halifax, England
For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

McDANEL REFRACTORY PORCELAIN COMPANY
Manufacturers of
PYROMETER TUBES AND INSULATORS
COMBUSTION TUBES AND BOATS
GAS ANALYSIS TUBES
LABORATORY GRINDING JARS
PORCELAIN MILL LININGS
PORCELAIN GRINDING BALLS
BEAVER FALLS PENNSYLVANIA

THREE ELEPHANT
BORAX
REG. U.S. PAT. OFF. REG. U.S. PAT. OFF.
AND BORIC ACID
GUARANTEED OVER 99.5% PURE
AMERICAN POTASH & CHEMICAL CORPORATION
70 Pine Street, New York

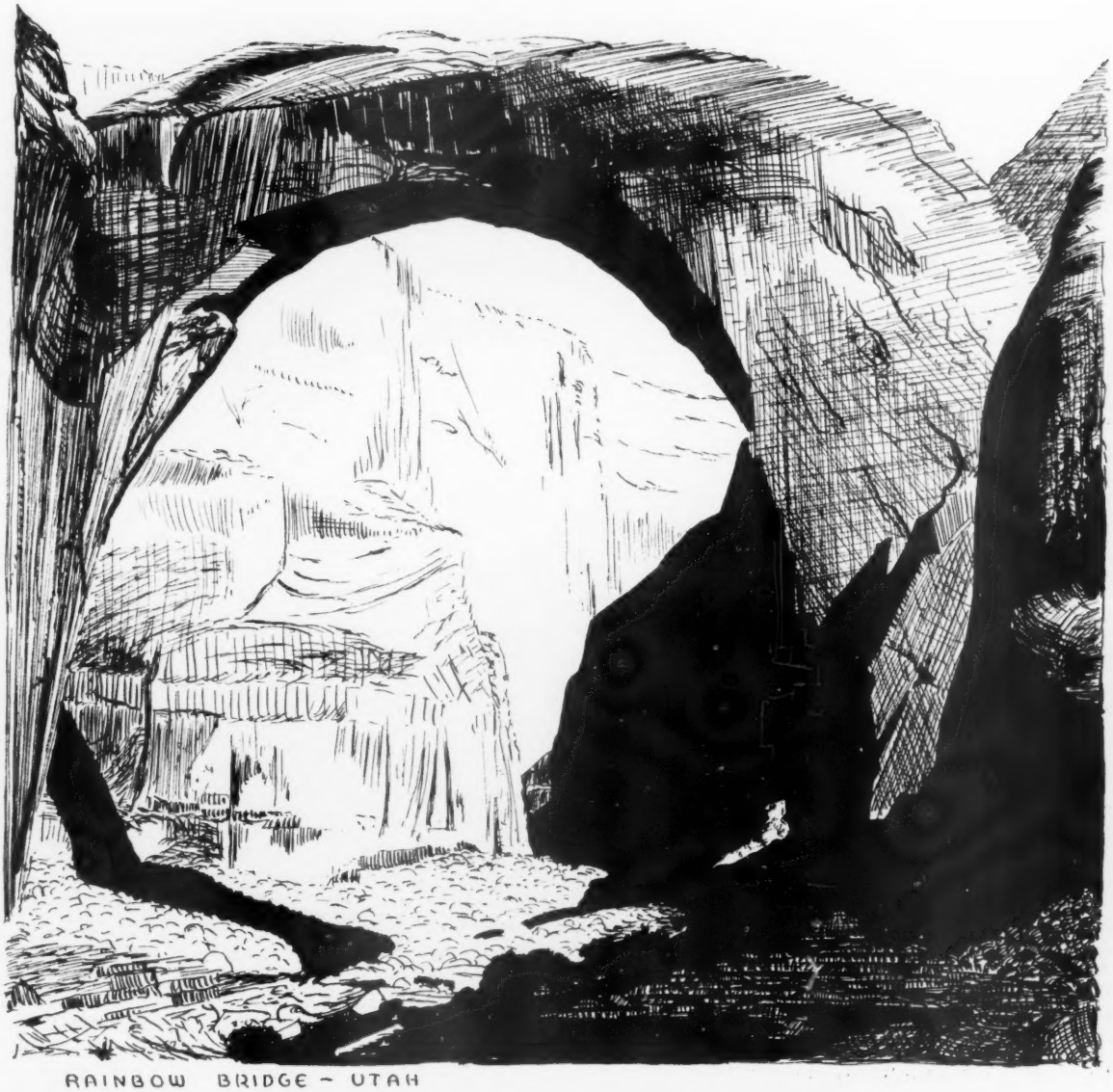
CLAYS
AIR-FLOATED SHREDDED GROUND
FOR EVERY CERAMIC NEED
UNITED CLAY MINES
CORPORATION
TRENTON . . . . NEW JERSEY

HARTFORD-EMPIRE COMPANY
HARTFORD, CONN.
Engineers and Licensors
FEEDERS FORMING MACHINES CONVEYORS
STACKERS LEHRS

HIT... OR MISS... METHODS

. . . of ordering alkalies cost you money. Use Solvay Alkalies in making your glass and be *certain!* Write today for a copy of the *Solvay Products Book.*

SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 RECTOR STREET NEW YORK, N. Y.
BRANCH SALES OFFICES:
Boston Charlotte Chicago Cincinnati Cleveland
Detroit New Orleans New York
Philadelphia Pittsburgh St. Louis Syracuse
SOLVAY ALKALIES



RAINBOW BRIDGE - UTAH

BRILLIANT COLORING— AMERICA'S HERITAGE

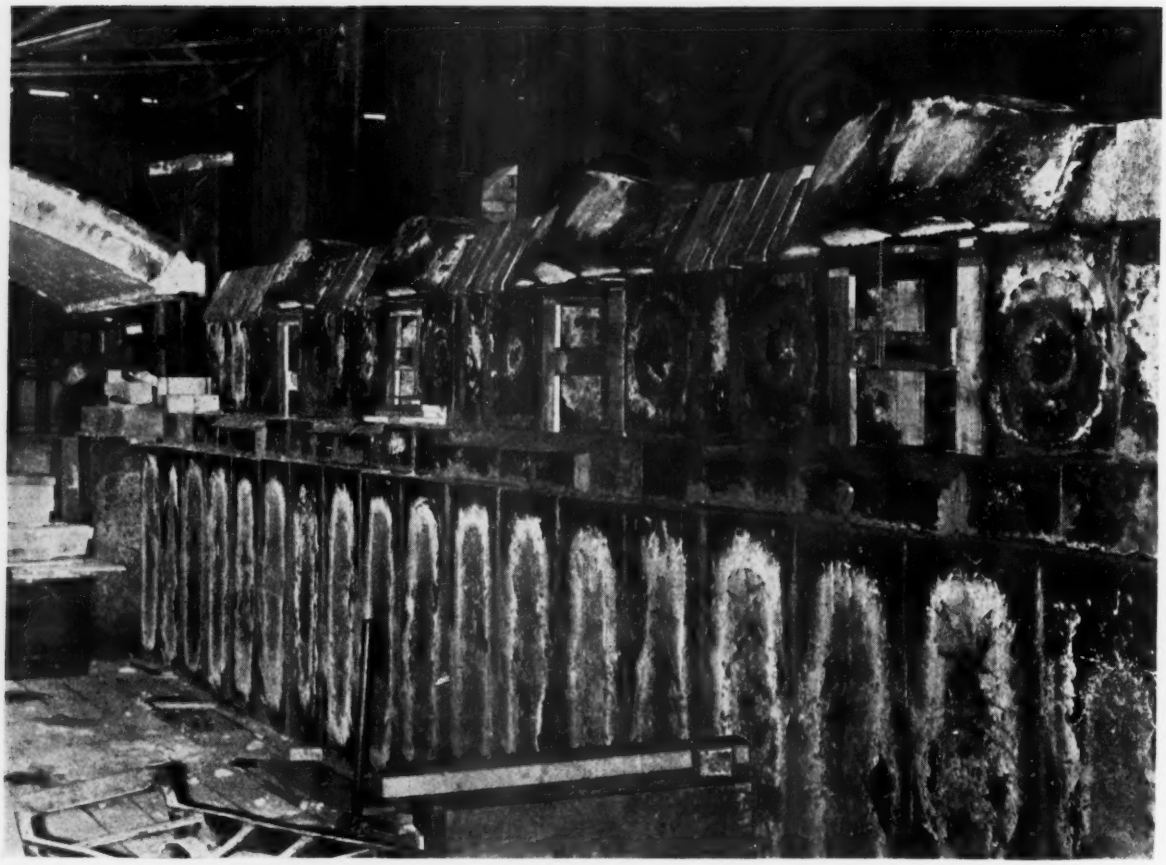
All around us is the brilliant color of the American landscape. This color is America—a part of our very lives.

In designing ceramics to fit this background of nature, design in color—and for beautiful ceramics, specify Harshaw colors.

Underglaze and overglaze colors, glaze stains, body stains, colors and chemicals for all branches of the ceramic art.

THE HARSHAW CHEMICAL CO.

Cleveland, Ohio, and Principal Cities



WHERE SHOULD CORHART* ELECTROCAST BE USED?

THE photographic construction detail above shows the extent of Corhart* Standard Electrocast used in the side and breast-wall locations recommended for a typical modern glass furnace.

The use of Corhart* Standard Electrocast in all these locations has literally grown by the necessity and the experience of furnace operators. In practically all cases, Corhart* Standard Electrocast has won its acceptance through hard trial competition with all other materials available for the purpose.

Extending over five continents and a period of more than ten years, the increasing use of Corhart* Standard Electrocast is the best proof possible that Standard Electrocast offers greater economy than any other refractory material commercially available. The use of such a material for mere "spot" fortification is to deny the accumulated experience of almost every important glass manufacturer in the world.

Corhart Refractories Co., Incorporated, 16th & Lee Streets, Louisville, Kentucky. . . . . *In Europe:* L'Electro Refractaire, Paris. *In Japan:* Asahi Glass Co., Tokio.

* Not a product, but a trade-mark.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

THE BULLETIN
OF THE AMERICAN CERAMIC SOCIETY

A Monthly Publication Devoted to Proceedings of The Society and Promotion of Cooperative Research of Technical, Scientific, and Art Questions

Volume 19 **SEPTEMBER, 1940** **Number 9**

PAPERS

SOME FACTORS AFFECTING PLASTER MOLD LIFE*

By M. C. Dailey and B. Nies†

Abstract

Some of the factors causing the early failure of plaster molds used to form ceramic ware are discussed. The causes of the occurrence and the means of reducing pinholes and "high spots" in molds are given. Methods to prevent mold losses occurring from thermal shock and mold calcination are outlined, and suggested specifications are listed for plaster handling and mixing and for mold storage and drying to obtain maximum mold life.

I. Introduction

Wiss, Camp and Ladoo[1] have outlined the basic factors involved in obtaining maximum life from plaster molds used by the ceramic industry to shape clay bodies. This paper will discuss in further detail some of the factors involved and also present data which have been developed recently.

Mold life in the average pottery in most cases has lengthened considerably during the past few years. This increase in life results from (1) continuing quality improvements in the manufacture of pottery plaster and (2) more intelligent use of plaster under uniform and controlled conditions in the potteries. Experience in the field indicates, however, that the best practice in the manipulation and use of gypsum plaster is not universally followed. In those cases where optimum performance is not being obtained, probably only minor changes in the technique of making and using molds are required to approach these conditions.

II. Factors Affecting Mold Life

Plaster molds are generally worn out and discarded as the result of the loss of material or set plaster from the working surface of the mold. This material loss is caused by (*a*) abrasion of set plaster by the clay body and (*b*) solution of plaster by water and chemicals contained in the clay slip.

Other factors may effect mold failure, such as cracking from thermal or mechanical shock; mold calcination during drying; formation of efflorescence on mold surfaces, caused by the deposition of chemicals from clay-slip suspensions; or strength failure, caused by "sweat out." Sweating is induced by prolonged storage or use of molds under continuous wet conditions. In some potteries and for certain types of uses, some of these secondary factors affecting mold performance are important. Loss of material from the mold face, however, which is bound to occur under use, is the usual reason for mold wear out.

Material loss from mold working surfaces may develop the following types of mold defects: (1) pinhole formation, manifested by the development of small pits in the surface of the mold, which usually become larger with continued mold use; (2) "high-spot" formation, evidenced by the development of "rough" mold surfaces with small projections extending above the mold surface; (3) loss of design detail on raised portions of the mold and shoulders; and (4) mold enlargement, with corresponding dimensional changes in clay bodies formed by the molds.

The rate of wear of pottery molds is largely a function of the strength and hardness of the mold. These properties are influenced by such factors as plaster-water ratio used in mixing, plaster purity and fineness, and proper mixing procedure. These factors will not be considered in detail at present, as the basic principles involved have been previously outlined and are recognized by users in the ceramic field. If the

* Presented at the Forty-Second Annual Meeting, The American Ceramic Society, Toronto, Canada, April 9, 1940 (White Wares Division). Received April 9, 1940.

† Manager Commercial Research and Research Chemist, respectively, of the U. S. Gypsum Company.

[1] J. E. Wiss, T. P. Camp, and R. B. Ladoo, "Gypsum Plaster in the Ceramic Industries," *Jour. Amer. Ceram. Soc.*, **13** [5] 287–314 (1930).

use of a good grade of pottery plaster is assumed, and if a proper plaster-water ratio for mixing, proper soaking and mixing of the plaster, and proper storage and use of molds are developed, the eventual failure of molds may be caused by loss of design detail or dimensional change in the mold and not by pinholes or high-spot formation.

III. Pinhole Formation in Plaster Molds

(1) Caused by Plaster

Because plaster is used in the form of an extremely fine powder, it inevitably carries with it a certain amount of air as it is added to the mixing water. Unless this air is completely removed during the mixing operation, it will remain distributed throughout the mass of the mold in the form of small bubbles. Then, as the face of the mold becomes worn through use, the bubbles nearest the working surface are increasingly exposed and are seen as pinholes, ranging in diameter from the limit of visibility up to $^1/_{32}$ to $^1/_{16}$ inch in diameter. If the pinholes eventually become sufficiently large and numerous to render mold-formed ware rough in surface appearance, the mold must be discarded. The development of pinholing to any degree is objectionable, even though it is not an immediate cause of mold failure.

The tendency of a plaster to occlude air is influenced considerably by the particle-size distribution of the plaster. The greatest freedom from pinholes is shown by plasters so processed as to contain a relatively small proportion of +325-mesh (44-micron) material, the majority of the particles being graded in fineness rather uniformly throughout the range of 0 to 40 microns in diameter.

The particle-size distribution of three types of pottery plaster is shown in Fig. 1; Fig. 2 is a photograph of pinhole test wafers prepared from the plasters whose particle-size distribution curves are shown in Fig. 1.

Particle-size distribution below an average of 50-micron particle diameter is determined by a modification of the Wagner turbidimeter method, which is commonly used to measure the surface area of Portland cements. Alcohol is used as a suspending fluid, and particle sizes are calculated as a function of rate of settling of a thoroughly dispersed sample of plaster in the suspending fluid. An accurately calibrated hydrometer is used to follow changes in specific gravity of the suspension as a function of time.

The pinhole test wafers are prepared as follows: A small sample, about 0.5 to 1.0 cc. in size, is taken from the center of a mixed batch of plaster and squeezed out to form a thin wafer between two clean, unscratched glass plates, 4 in. square. The plates are separated by strips of gummed tape, 0.005 in. thick, pasted to adjoining plate edges so that the total thickness of the test wafer formed between the plates is 0.01 inch. Sufficient slurry should be used to form a wafer about $2^1/_2$ to 3 inches in diameter. If pinholes are present, they will be revealed when the test specimen is held to the light. If the plaster sample is allowed to set between the plates, the resulting wafer may be removed by immersion in water and may be used for reference. The degree of pinholing revealed by this test checks closely with pinholing tendencies developed by actual molds in use.

Plaster A (Figs. 1 and 2) is representative of a high quality, commercial-grade pottery plaster in common use; plaster B is a special experimental plaster; and plaster C is a new type of pottery plaster which has been recently introduced. All three plasters were made from gypsum rock of the same purity; they have equal consistency and they possess approximately equivalent setting time, strength, and hardness.

The pinhole test wafers shown in Fig. 2 are from identically prepared hand-mixed slurries of the plasters. The wafers accurately represent the pinholing tendencies of the different plasters which have been mixed by hand. The large, numerous pinholes in plaster B are caused by the relatively large proportion of

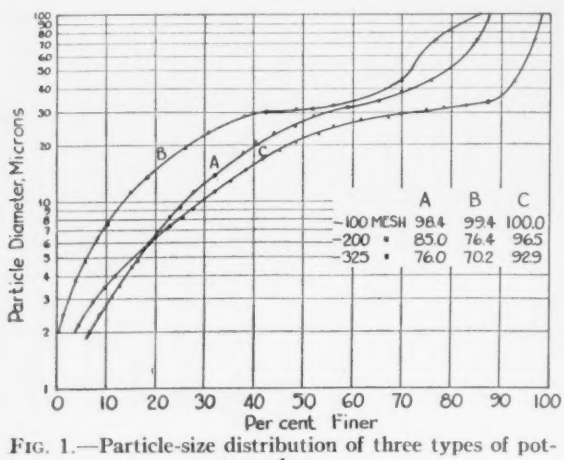


FIG. 1.—Particle-size distribution of three types of pottery plasters.

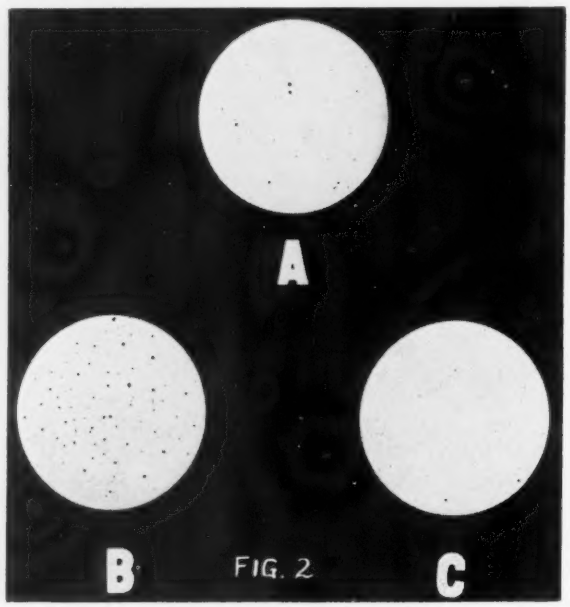


FIG. 2.—Pinholing tendencies of three types of pottery plasters.

+325-mesh material and the small proportion of ultrafines (−5 micron). Plaster C is definitely superior to the standard, plaster A, owing to the absence of +325-mesh particles and to its uniform gradation of particle size below 40 microns.

Many impurities have the effect of increasing pinholes in plaster; pottery plaster, for this reason, is manufactured from carefully selected, pure gypsum rock, and precautions are observed throughout the manufacturing process to avoid contamination of any sort.

(2) Pinhole Formation as Affected by Technique of Use

(i) *Mixing:* Mixing technique exerts a powerful effect on the number and size of pinholes that will be developed by a mix of plaster and water. The trend in recent years toward the mechanical mixing of pottery plaster has resulted in a general improvement of molds and greater freedom from pinholes. The many types of mixing equipment in use range from slow-speed, paddle mixers to high-speed, small-diameter propeller types. A corresponding variation in pinhole elimination is found.

The inherent tendency of any plaster to occlude air is a function of several factors, and if plaster batches are mixed by hand or with an inefficient mechanical mixer, these factors assume a large relative importance. By using a properly designed mechanical mixer, however, molds may be produced, which, for practical purposes, show complete freedom from pinholes of a size large enough to affect the surface smoothness of the ware, even though the plaster employed may not possess ideal pinholing qualities as judged by the hand mixes.

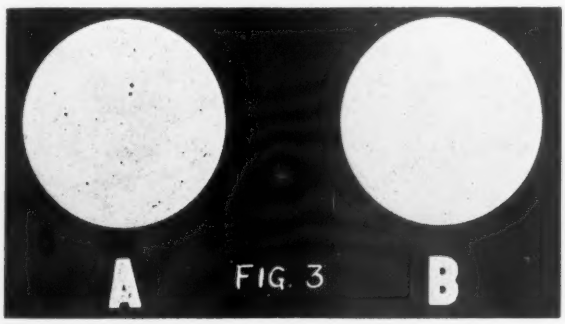


FIG. 3.—Pinhole test wafers showing effect of mechanical vs. hand mixing of pottery plaster.

Figure 3 illustrates the degree of improvement possible by the use of proper mixing. Test wafer A is from a typical pottery plaster mixed by hand, with a water-to-plaster ratio of 0.72. Plaster was sifted into the water, allowed to soak three minutes, and hand-mixed four minutes, in accordance with the recommended procedure for hand mixing the plaster, to obtain the greatest possible freedom from pinholes. Wafer B is from the same plaster and mixed at the same water ratio as A, but an efficient mechanical mixing process was used; sample B is practically free of pinholes.

(1940)

The mechanical mixer removes pinhole-forming air bubbles by effecting coalescence of the tiny bubbles into larger bubbles, which are easily whipped out of the mix. Air should not be whipped into the mix during this process, particularly if it is being rapidly agitated.

The following specifications for efficient mechanical mixing have been developed as the result of an extensive series of tests on this subject, and it may be used as a guide in the modification of existing equipment or in the purchase of new mechanical mixers. The dimensions given apply to batches of 40 to 80 lb. of plaster; modifications will be necessary for smaller or larger batches. The directions apply to normal pottery plasters mixed at water-plaster ratios of 65 to 78 lb. of water per 100 lb. of plaster.

(ii) *Mixing Vessel:* The shape is not important, but it should preferably be circular, with the top diameter about equal to the height of the vessel; the bottom diameter should be equal to about 0.8 of the top diameter; the bottom should preferably be slightly rounded, particularly at the junction of sides and bottom to prevent the formation of "dead" areas during mixing; and the size of the vessel should be so chosen that it will be filled to two-thirds to three-fourths of its capacity by the batch.

(iii) *Agitator:* The propeller-type mixer of proper design is the most effective, and either one or two 3-blade propellers on a single shaft may be used.

(iv) *Propeller-Blade Dimensions:* The diameter should be $5\frac{1}{2}$ to 7 in.; maximum width, $2\frac{3}{4}$ in.; and pitch, 20 to 30 degrees.

(v) *Position in Mixing Vessel:* The bottom propeller should be approximately centered about 2 in. above the mixer bottom; the drive shaft may be vertical or inclined to a maximum angle of about 20 degrees from vertical; there are indications that better results are obtained with the inclination of the drive shaft at an angle of 10 to 20 degrees.

(vi) *Speed of Rotation:* The preferred rate is 350 to 450 r.p.m. With mixing equipment of this type, a soaking time of three minutes and a mixing time of three minutes should be ample with pottery plasters of normal time of set. The proper operation of the mixer may be gauged by the complete absence of splashing, the presence of positive and rapid circulation throughout the mix with no dead spots, and the appearance of a steep vortex about the drive shaft. The vortex should not extend to the propeller; if it does, air will be whipped into the mix.

Some recent tests indicate that reversing the normal direction of rotation of the propeller may be an effective means of mixing to eliminate pinholes. The slurry is pulled from the bottom up along the agitator shaft and is discharged from the top toward the side of the vessel. This departure from the usual mixing practice may justify investigation.

Complete freedom from pinholing may be obtained by mixing under 15 to 20 in. of vacuum. A few potteries are employing vacuum mixing, but heavy and cumbersome equipment is required for its proper operation. The efficiency obtained with suitable mechanical mixing is usually sufficiently high that the additional expense

of vacuum-mixing equipment and operation is not justified.

(vii) *Water-Plaster Ratio:* Other factors than pinhole formation enter into the determination of the proper water-plaster ratio to be used in mixing pottery plaster. The ratio employed largely determines the strength, hardness, rate of wear, and absorption characteristics of the finished mold. To prevent pinholes, the best results are obtained with normal pottery plaster, using a ratio of about 68 to 75 lb. of water to 100 lb. of plaster. If less water is used, the mix is so stiff that coalescence and removal of tiny air bubbles are difficult to effect; with more water, the mix is too thin to obtain uniformity, and molds are soft, weak, and wear rapidly.

(viii) *Contamination:* Minute amounts of soap, oil, set plaster scale, and clay dust definitely increase pinholing tendencies. Plaster storage should be kept clean and protected, and plaster mixing vessels and agitators should be kept clean and free from set plaster. Clean water should be used for mixing, and cases should be wiped dry before use. These precautions pay dividends in uniformity of plaster performance and freedom from pinholes.

(ix) *Dissolved Gases in Mixing Water:* More complaints on pinholing are received in winter than in summer, and many of these have been traced to the mixing water. Cold water contains more dissolved oxygen than warm water. High bicarbonate hardness is another source of pinholes. When hard water of this type is employed for mixing with plaster, carbon dioxide gas is liberated by the reaction,

$$Ca(HCO_3)_2 \longrightarrow CaCO_3 + H_2O + CO_2.$$

This reaction is accelerated by the common ion effect, the addition of plaster ($CaSO_4 \cdot {}^1/_2 H_2O$) decreasing the solubility of $Ca(HCO_3)_2$ in the mixing water, which causes the reaction to proceed in the indicated direction. If the mixing water is boiled and cooled before its use, pinhole formation oftentimes will materially decrease. High concentrations of organic impurities in water will also cause pinholes.

IV. High Spots in Molds

(1) Presence of Oversize Material in Plaster

Another common cause of early mold failure is the development of minute projections on the working surface of the mold, known as "high spots." Their presence is particularly objectionable, because, unlike pinholes, they cause depressions in the surface of the ware which cannot be effaced by sponging. High spots can develop only when the mold surface is not uniformly resistant to the effect of abrasion and solution by the clay body. Microscopic examination of these spots indicate that they usually consist of abnormally large particles (+50-mesh) of plaster or of harder and less soluble impurities, such as anhydrite ($CaSO_4$), that occur in small amounts in the gypsum rock from which pottery plaster is manufactured. A plaster which screens 100% through 50-mesh will usually show satisfactory freedom from high spots, although better results and smoother molds are obtained with a grind of 99.9 to 100% through 100-mesh. Hard particles, finer than 100-mesh, are so small that they will not show up as high spots on mold surfaces as the mold face wears down under use.

Commercial means of manufacturing a satisfactory pottery plaster to meet these stringent grind specifications have not been available until recently. Air separation or finer grinding of present types of pottery plaster may adversely affect plaster for pottery use as follows: (1) by increasing its consistency (that is, the amount of water required for the production of a workable, pourable mix), which necessitates the use of a higher water-plaster ratio with the production of softer, weaker molds that wear rapidly under use; and (2) by increasing the "plasticity" of the plaster, which makes it difficult to soak and mix to a smooth, uniform slurry.

Recent developments have resulted in the production of a pottery plaster of normal pottery-plaster consistency, excellent soaking, mixing, and pinholing characteristics, combined with practically complete freedom from plus 100-mesh material.

(2) Contamination in Use

Set plaster scale or rust from the mixing buckets and mixers will settle to the mold surfaces as the mixes are poured and will show up as high spots on finished molds. This is another good reason to maintain such equipment clean and free from set plaster.

(3) Technique to Prevent High Spots

The few coarse particles present in the pottery plaster of today tend to settle before the plaster has set, resulting in a concentration of coarse, high-spot producing particles at or near the mold face. This tendency may be reduced by (*a*) maintaining the water-plaster ratio at as low a value as is practical and (*b*) soaking and mixing in accordance with the recommended procedure; the molds should not be poured until the plaster is well "creamed."

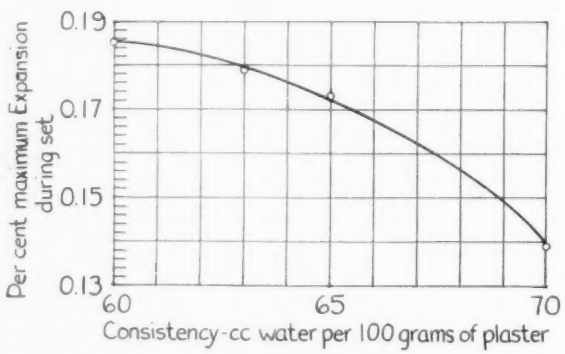


FIG. 4.—Effect of variation in water-plaster ratio on setting expansion of pottery plaster.

V. Mold Cracking and Distortion

(1) Plaster Settling

"Settling" results from (*a*) insufficient or incomplete mixing, (*b*) pouring the molds before the plaster has "creamed," or (*c*) the use of an excessively high

water-plaster ratio. Settling tends to produce a heterogeneity of density throughout the mold. Such a mold may be considered to be made up of an infinite number of plaster layers, each of which possesses an increasing water-plaster ratio from bottom to top. Plaster of Paris expands slightly on setting, and the amount of this setting expansion increases as the water-plaster ratio is reduced (Fig. 4). If molds are cast under conditions which permit the development of a gradient in their density before the plaster has set, differential setting expansion can operate to set up stresses within the mold body. These stresses may be of sufficient magnitude to cause mold warping, distortion, or even cracking before the mold is put in use. Such stresses, in addition, will render molds more vulnerable to thermal and mechanical shock. Proper mixing and timing for pouring the cases will prevent the establishment of such stresses.

(2) Thermal Shock

Occasional mold losses in potteries are the result of cracking or breaking caused by "thermal shock" when molds are subjected to sudden temperature changes. Under severe conditions, stresses are set up of sufficient magnitude to cause mold failure.

The thermal-expansion coefficient of set gypsum is 0.0000083 in. per inch per °F. Because this coefficient is not influenced appreciably by mold density, a normal variation in the water-plaster ratio will not affect mold dimensional changes caused by temperature differentials.

Mold failure occasioned by thermal shock is influenced by (*a*) the size and shape of molds, (*b*) the free water content of molds, (*c*) internal stresses in molds, which may be present as a result of differential setting expansion, and (*d*) temperature differentials to which molds are subjected.

As the mold size and shape usually are determined by ware-forming requirements, they cannot be altered appreciably. To avoid thermal-shock failure, sudden changes in the cross-section thickness of molds and irregularities in dimensions should be avoided as far as possible.

Set gypsum possesses maximum strength and hardness when it is bone dry, but it is also most brittle in a bone-dry condition, and the presence of a small amount of free water in the molds is good insurance against loss by thermal shock. Painting the mold edges and bottoms with a 10% solution of corn sugar will help considerably to prevent the cracking of molds in storage.

Thermal-shock failure may be prevented entirely by the proper storage and use of molds in the pottery. Storage-room temperatures should be kept uniform and below 100°F.; forced-air circulation should be provided if possible, and the relative humidity should be kept at 20 to 30%. The molds should not be exposed to sudden temperature changes. The increased use of automatic jiggering machines and the natural urge to lower production costs have resulted in a tendency to increase mold drier-room temperatures in an effort to get more turns per day per mold. Driers, particularly on jigger operation, should be designed so that the molds are given an opportunity to cool to a temperature of not over 90° to 100°F. when they reach the jiggering machine. Increased drying rates may be obtained by increasing the rate of air circulation through the drier rather than by increasing drier temperatures, and sufficient time should be provided to anneal the molds after they leave the warmest drier zone and before their re-use. Many molds have been cracked by thermal shock when cold, wet clay is slapped onto hot, dry, jigger molds.

(3) Mold Calcination

Some knowledge of the chemistry of pottery plaster is necessary to understand the factors involved in mold calcination. Pottery plaster, chemically, is calcium sulfate hemihydrate ($CaSO_4 \cdot {}^1/_2\, H_2O$). When mixed with water, the plaster "sets," that is, it reacts with part of the mixing water to form a higher hydrate, calcium sulfate dihydrate ($CaSO_4 \cdot 2H_2O$),

$$CaSO_4 \cdot {}^1/_2\, H_2O + 1{}^1/_2\, H_2O \longrightarrow CaSO_4 \cdot 2H_2O.$$

Set plaster molds, therefore, are composed entirely of $CaSO_4 \cdot 2H_2O$, or gypsum. This material is converted back to the hemihydrate form under proper conditions of temperature and humidity. Figure 5 shows the theoretical relation between temperature and humidity required to "calcine" gypsum, that is, to convert it to the lower hydrate form. Calcination will proceed at points below the line. Gypsum remains stable as such under temperature-humidity conditions defined by the area above the curve. This curve is adapted from the van't Hoff vapor-pressure measurements on gypsum.[2]

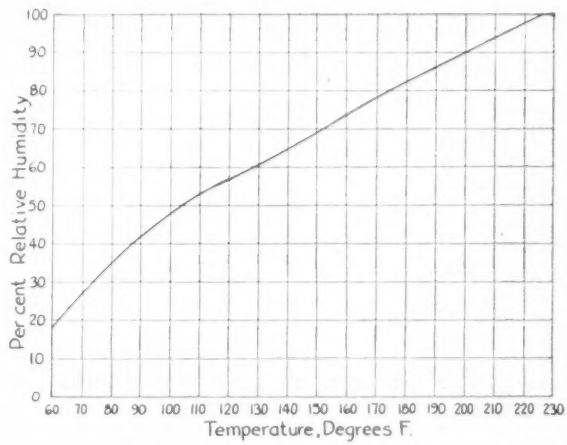


FIG. 5.—System $CaSO_4 \cdot 2H_2O$–$CaSO_4 \cdot {}^1/_2\, H_2O + 1{}^1/_2\, H_2O$; area below curve indicates theoretical temperature-humidity conditions under which calcination of set gypsum will occur as exposed to air.

The curve indicates that mold calcination may occur at normal temperatures well below 100°F. under conditions of low humidity. The rate of calcination, under such conditions, is so slow that no appreciable calcination results at temperatures under 100° to 110°F., even at humidities as low as 5 to 10%, with molds stored for a period of months or even of years.

[2] J. H. van't Hoff and E. F. Armstrong, *Sitzber. Akad.*, 563 (1900).

Figure 6 illustrates the effect of humidity on the rate of calcination at 150°F. Test specimens were cast in the form of slabs, 5 by 3 by $^3/_{16}$ in., and at a consistency of 60 cc. After they were dried to constant weight at 100°F., they were placed on a rack in a sealed container over a dehydrating agent, which was adjusted to provide a constant water-vapor pressure equivalent to the desired relative humidity. The entire container was placed in an oven which was maintained at constant temperature. For vapor pressures equivalent to relative humidities of 10, 20, and 40%, solutions of the proper concentrations of sulfuric acid (H_2SO_4) were used as the dehydrating agents. Phosphorus pentoxide (P_2O_5) was used as the dehydrating agent to provide vapor pressures approaching zero.

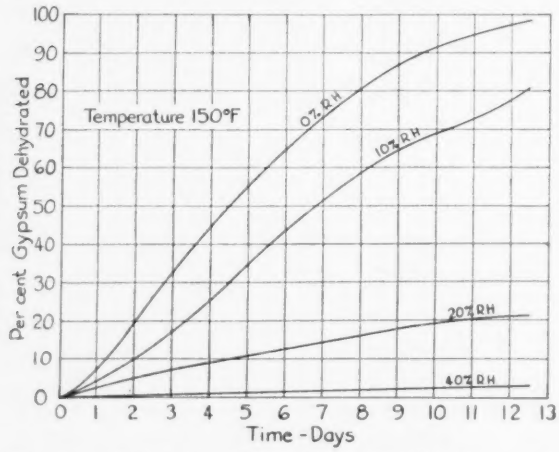


FIG. 6.—Effect of humidity on rate of calcination of set pottery plaster at 150°F.

The slabs were weighed at intervals of twenty-four hours during the course of the test, and the percentage of gypsum dehydrated was calculated from the loss of weight shown by the specimens. Figure 6 shows the marked effect that humidity exerts on the rate of calcination.

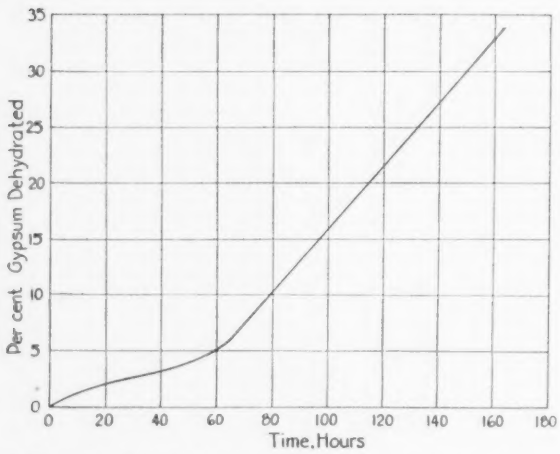


FIG. 7.—Rate of calcination of set pottery plaster at 150°F., 20% relative humidity, and exposed to rapid air circulation.

Figure 7 shows the rate of calcination of a test slab, similar in size and composition to those shown in Fig. 6, but exposed in an oven maintained at 150°F., 20% relative humidity, and with air circulated past the slab at a rate of about 300 ft. per min. Air circulation will accelerate the rate of calcination when temperature and humidity conditions permit calcination.

The rate of calcination at temperatures below 120°F. is slow, even with rapid air circulation, provided humidity is maintained above about 10%.

Mold calcination is evidenced in the pottery by the formation of soft, chalky surfaces. The edges and bottoms of molds usually are first attacked, or calcination may show up on thin portions of the mold where the cross-section area is small. Calcination of molds cannot take place at temperatures below 226°F. as long as free water is present in the molds (shown by the calcination curve in Fig. 5). Because mold edges, bottoms, and areas of thin cross section dry first in actual use, the effects of calcination show up first in these locations. If the mold edges and bottoms are painted with a 10% solution of corn sugar (dextrose), the rate of drying from these exposed portions is slightly retarded. Because corn sugar also seems to raise slightly the calcination temperature of gypsum, this treatment will protect molds against a moderate amount of calcination abuse.

Suggestions are made for drying molds to obtain a maximum rate of drying consistent with good mold performance and also to obtain resistance to mold loss from the effect of thermal shock and calcination. These suggestions will apply principally to jigger-mold operations or to operations in which molds are carried through the drier on some type of conveyer. (1) Drier temperature may be safely maintained at 200° to 225°F. in the first section of the drier where molds contain 5 to 20% of free water absorbed from the ware. (2) Drier temperatures should be progressively decreased as drying proceeds; drier air temperature should not exceed 90° to 100°F. at the point of the mold exit from the drier; air dampers and baffles may be used to regulate temperatures at different points in the drier. (3) Rapid air circulation rather than high temperatures should be provided for fast drying; drier and mold arrangement in the drier therefore should be so designed that all of the mold surfaces and the molds are subjected to uniform drying conditions. (4) The use of high-temperature steam coils or hot-air intake pipes near the discharge end of the drier should be avoided; air from intake lines should not impinge directly on molds at any point in the drier. (5) Relative humidities above 10%, particularly near the drier exit, should be maintained. (6) Several recording thermometers should be used in the drier to obtain proper control of temperature.

VI. Summary

This study leads to several recommendations for efficiency in handling pottery plaster and for securing maximum life and satisfactory use from plaster molds:

(1) Plaster should be stored before use in a dry place, and it should be protected from contamination with sub-

stances which may act to affect setting time and increase pinholing tendencies.

(2) Freedom from pinholes may be achieved by the prevention of contamination, use of proper mixing water, control of water-plaster ratio, and proper soaking and mixing; mechanical mixing is recommended, using a propeller-type mixer operated at 350 to 450 r.p.m.

(3) High-spot development may be prevented by (*a*) the use of pottery plaster containing a minimum amount of coarse particles, (*b*) proper soaking and mixing of plaster, (*c*) prevention of contamination by "set" scale or dirt, and (*d*) proper "creaming" of plaster mixes before pouring.

(4) Mold losses from thermal shock may be entirely prevented by protecting molds from exposure to sudden temperature changes in storage and use. Abrupt changes in cross-section dimensions of molds should be avoided, and molds should not be allowed to become bone dry in storage. Painting mold edges and bottoms with a 10% solution of corn sugar aids in protecting molds against thermal-shock abuse.

(5) Mold calcination may be avoided by proper temperature and humidity control in driers. Drying temperatures as high as 210° to 220°F. are satisfactory on wet molds, but, as drying proceeds, temperatures should be reduced to not over 100°F. Rapid air circulation rather than high temperature is recommended as a means of accelerating the rate of drying. Painting mold edges and bottoms with 10% of dextrose aids in preventing calcination.

Research Laboratories
United States Gypsum Company
Chicago, Illinois

METHODS USED TO REDUCE SURFACE LINES ON GLASS*

By R. L. Shute

Abstract

A résumé of difficulties arising from the presence of surface lines on glass, a description of equipment, methods of combating these defects, and the results obtained are presented.

I. Introduction

(1) Historical Survey

In the early history of glass-tank operation, at the melting temperatures employed, a thin layer or scum consisting possibly of uncombined fluxes or glass of slightly lower density often formed on the surface of the glass in the furnace. This layer appeared as lines or striae in the finished glass and was objectionable. To prevent this defect as much as possible from appearing in the glass, clay floaters were placed across the furnace to direct the surface layer toward the sides of the furnace where it could be removed by skimming. The use of floaters, however, gave rise to another defect known as floater lines. These lines originated from the clay of the floaters which was dissolved by the hot glass and drawn off in a series of coarse parallel lines which usually persisted in some particular area in the furnace.

To break up the floater lines, gathering rings were used in hand blowing. These rings, which acted as secondary floaters, tended to break up lines in the glass at the working end of the furnace and to provide a small definite area which could be skimmed as often as necessary.

When the continuous machines of the Colburn type were invented, gathering rings could not be used. Lines from floaters across the melting end of the furnace were worse than the striae from the surface layer of glass, and the floaters were also abandoned for this type of machine.

There was difficulty in getting good glass from furnaces without floaters, and many different designs of furnaces and ports were tested.

Soft smoky fires and large percentages of cullet were necessary to produce even a fair grade of glass. This condition resulted in high fuel and material costs as it was found necessary to melt the batch in special furnaces to insure a supply of cullet of dependable quality. Extraordinary precautions were also taken to insure the uniformity of the raw materials, and the resulting glasses were carefully analyzed to detect changes in composition. Furnace operation was extremely difficult owing to unexplainable outbursts of lines and striae.

An effort was made to return to the use of melting tank floaters by supplementing them with floaters of less depth located across the refining channel within a short distance of the drawing machine. This arrangement reduced the coarse lines from the melting tank floaters but introduced numerous fine lines which originated from the shallow floater. Although this arrangement was not satisfactory, it suggested the idea of using a water cooler as a substitute for the shallow floaters (Fig. 1).

II. Test Results

Experiments with the cooler demonstrated that an immersion of 1 to $1^1/_2$ inches below the level of the glass was sufficient to mix the surface glass thoroughly enough to eliminate fine striae completely for about 24 hours.

* Presented at the Forty-First Annual Meeting, American Ceramic Society, Chicago, Ill., April 19, 1939 (Glass Division). Received July 28, 1939; revised copy received November 20, 1939.

Based on a thesis submitted by the author in partial fulfillment of the requirements for the degree of Ceramic Engineer, University of Illinois, June, 1939.

When the cooler is placed in the glass, a coating begins to form over the submerged portion which increases to a thickness of about $^3/_8$ inch in 24 hours. After the coating of chilled glass has accumulated to this depth, scattered lines reappear in the sheet. During this time, the portion of the cooler above the glass has accumulated a white coating, consisting chiefly of sodium sulfate, which finally becomes heavy enough to fall off in patches. These patches of the coating are not melted but are drawn out into rough, granular-appearing streaks which cause some loss of glass.

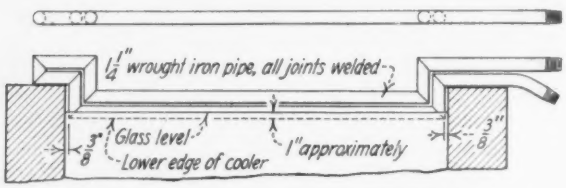


FIG. 1.—Water-cooled skim bar in position.

The best practice has been to remove the cooler from the furnace at intervals of eight to ten hours and wash off the white deposits with a stream of water. The cold glass from the submerged part of the cooler remains on the surface of the glass, and it may be raked to the side of the furnace and ladeled out while the cooler is being cleaned. The operation need not take over five minutes when the crew is familiar with the work.

The cooler is supplied with water through flexible hose connections. The water must be passing through the cooler when it is placed in the furnace, and, of course, it must never be shut off or allowed to fail while the cooler is in service. If the cooler is properly welded and the water supply is maintained, no difficulty need be expected from its use.

The cooler may be handled in and out of the furnace by a balancing pipe which may be hooked over the portion of the cooler outside the furnace. The pole should be supplied with a ring by means of which the unit may be lifted with an overhead crane or light chain fall on an I-beam trolley. The hose connections must be long enough to permit removal of the cooler from the furnace. Considerable care should be exercised to prevent the jarring of loose patches of the white coating, mentioned previously, as the cooler is being removed for cleaning. When the cooler is placed in the furnace, it should be allowed to dip in the glass only at one end and about 30 seconds should elapse while the other end is lowered to its final position. If this precaution is not observed, some warping of the cooler may result.

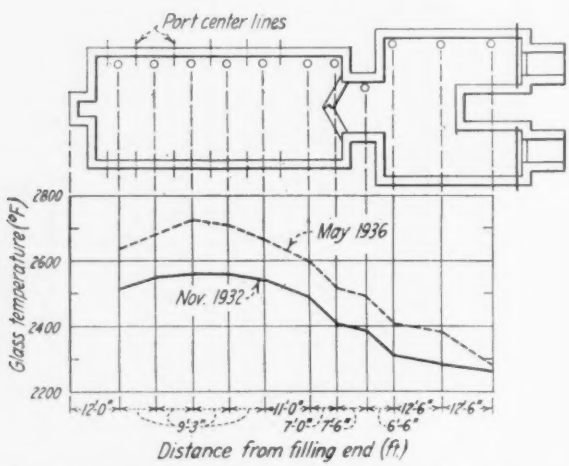


FIG. 2.—Glass temperature gradient lengthwise of furnace.

These coolers are usually built of $1^1/_4$-inch wrought-iron pipe or seamless steel tubing with all joints welded. They should be about $^3/_4$ inch shorter than the width of the channel in which they are to be used to allow clearance for removing and placing them in position.

III. Discussion of Results and Conclusions

The use of the cooler does not seem to have any effect on the amount of seed or bubbles in the glass when the temperature of the glass is above 2200°F.; below this temperature, cold streaks may appear.

The temperature of the glass, measured with a bare thermocouple at a distance of one inch below its surface, has been found to fall from 10° to 15°F. in passing under the cooler.

In a 14-foot channel, when the glass is at a temperature of approximately 2300°F., a $1^1/_4$-inch pipe cooler will require from 35 to 40 gallons of water per minute. The temperature of the water will be increased 65° to 75°F. in passing through the cooler.

There is no upper limit to the temperature of the glass in which this type of cooler may be used if sufficient water is provided to keep the exit temperature below 180°F. It has been tried in place of clay floaters across the furnace neck, using a 3-inch diameter pipe in place of $1^1/_4$-inch pipe. A cooler of this size is difficult to remove for cleaning, and as it carries an appreciable amount of heat out of the furnace, its use in this location has not been looked upon with much favor. The success of the water-cooled skim bar in the cooler parts of the furnace is marked. Through its use, a much more efficient type of fire may be used and higher melting temperatures are possible. Comparative temperatures, before and after the use of this device was instituted, are shown in Fig. 2.

The higher operating temperatures have not only increased the melting capacity of these furnaces but have made operation much more stable and dependable.

A striking reduction in the cullet requirements has also been secured, for the amount being used now is about 40% of the amount of raw batch instead of 100% formerly used. Higher operating temperatures have effected a reduction in the amount of seeds and bubbles in the finished glass.

The use of the floater skim-bar combination has resulted in an appreciable increase in the amount of glass produced per square foot of melting area, a decrease in the cullet and fuel requirements per ton melted, and an improvement in the quality of the glass.

DEPARTMENT OF CERAMIC ENGINEERING
UNIVERSITY OF ILLINOIS
URBANA, ILLINOIS

DEVELOPMENT OF A LABORATORY CONTINUOUS KILN*

By C. H. Commons, Jr., and E. E. Kunzman

Abstract

The account of the development of a laboratory tunnel kiln is presented, including details of construction, notes on the method of operation, and a summarization of the results obtained.

I. Purpose

Experimentation with various types of periodic kilns for laboratory use in firing glazes showed that none had sufficient capacity for any extensive research program, and the results obtained were often not comparable to commercial firings. A more flexible as well as a more economical method of firing glazes on a small scale was therefore definitely desirable.

II. Design

Consideration of the various factors led to the conclusion that for equivalent capacity, flexibility, and general utility, a continuous kiln would probably be least expensive and, on the whole, most desirable for the problems at hand.

(1) General Construction

Although this kiln was constructed for laboratory use, it had to be sufficiently well proportioned to reproduce, to a reasonable degree, the results obtained under commercial conditions. A length of 20 ft. with a working cross section of 6 in. square was selected as a basis of construction. Super-refractories were used so that experiments other than glaze formulation could be conducted at extremely high temperatures. This explains the use of zircon refractories in and about the hot zone. The economy of operation prescribed the use of insulating refractories at all points except for the burner blocks, sleds, and tracks, which were of a semi-vitrified zircon composition. The hot zone was made up of an insulating zircon refractory, and the remainder of the furnace was of a lightweight cellular refractory. The location of the various construction materials is shown on the sectional drawings of the furnace (Fig. 1).

(2) Cars and Tracks

The cars were sleds with runners which rode in the tracks so that the slabs could not wedge against the side walls.

(3) Heating Chamber

To promote uniformity of heat distribution in the hot zone, eight small burners were used on each side. The kiln was widened at this point to include $6^1/_2$ inches on each side to act as combustion chambers and a line of checkerwork through which the products of combustion passed. The inside of the checkerwork was placed in line with the inner wall of the kiln so that the hot gases would pass directly over the ware. A direct fire was used because some glazes would require such conditions, and those that would require indirect firing might easily be saggered.

Two extra ports and burners were placed on each side of the heating-up and cooling-down ends, adjacent to the hot zone, to be used to control the heat distribution more closely.

The top of the hot zone as well as the entire furnace was composed of removable slabs extending the entire width of the furnace. This type of construction was used as a safeguard to avoid a complete shutdown in case of possible wrecks or jams.

(4) Flues

As originally designed, the flue was placed in the top and 6 inches back from the charging end of the kiln. The sheet-iron stack was offset so that no scale could drop on the ware. The first run of the kiln showed that this caused the charging end to become too hot. Another flue therefore was built into the furnace, entering about $5^1/_2$ feet back of the original flue. A damper arrangement between these two flues allows the heat to be controlled to more nearly approximate good commercial practice. In a few cases, it might be advantageous to construct a third flue.

(5) Burners

The burners were constructed of pipe fittings, the relative sizes of which were found by a cut-and-try method. The nozzle of the air jet was turned out of a bar of cold-rolled steel and threaded to fit the pipe (Fig. 1).

Each burner has a manually operated valve for both gas and air to obtain a finer regulation of each point in relation to the control point. The quantity of gas and air introduced to the manifolds is controlled by a motor-driven, high-low type of valve actuated by a potentiometer type of recording pyrometer. The fuel used is city gas at a pressure of about 6 inches of water, and air is introduced at about 4 pounds pressure.

(6) Pusher

Angle-iron tracks were built onto the ends of the kiln to act as supports and guides for the incoming and outgoing cars. Below the track at the entrance end, a $^3/_4$-inch rod was fastened for the length of the 4 feet of track. A hand-operated, friction-type automobile jack operates along this rod pushing the ware into the furnace. An angle-iron plate was welded to the jack to transmit the power to the sleds.

* Presented at the Forty-Second Annual Meeting, The American Ceramic Society, Toronto, Canada, April 11, 1940 (White Wares Division). Received April 11, 1940.

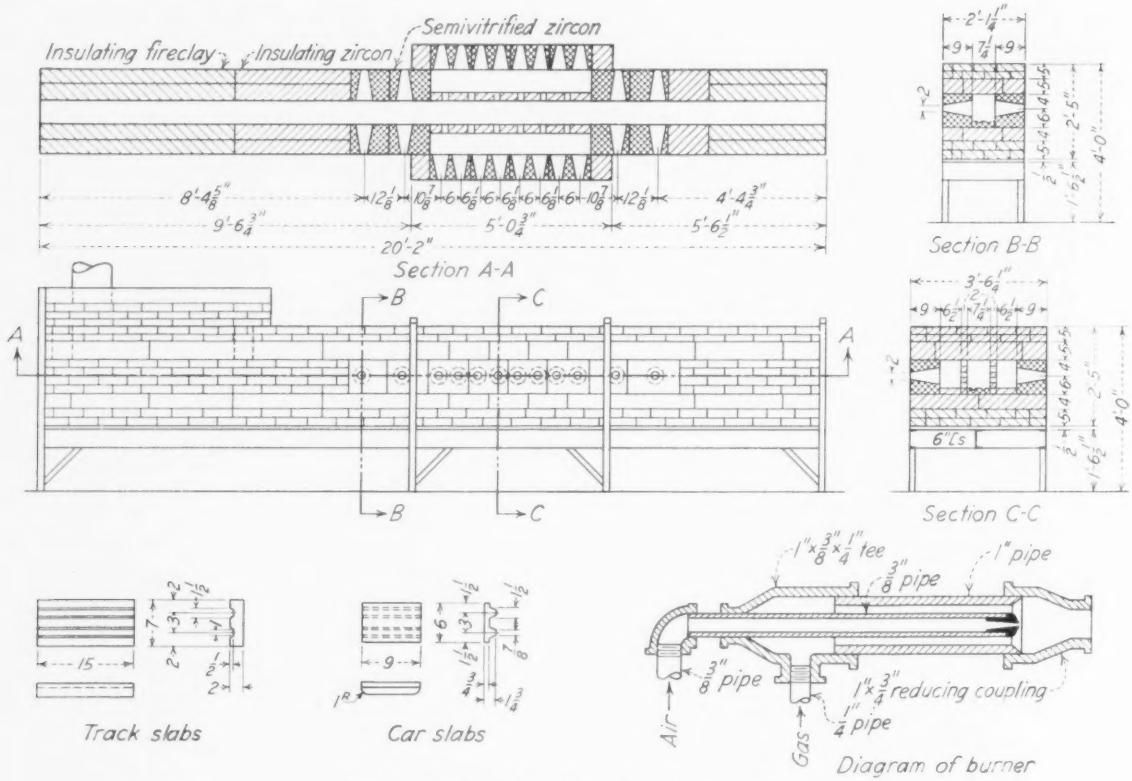


FIG. 1.—Sectional drawings of continuous kiln.

III. Operation

(1) Loading and Pushing

In the operation of the kiln, the ware is placed on the cars and is covered with tile setters, which may be stacked so that the small sizes can be set three tiers high if desired.

In setting the kiln, it was proved practical to place the ends of the tile setters fairly close together; otherwise, the velocity of the kiln gases was sufficient to blow the zircon sand, used as a setting media, up onto the ware. When the setters were placed within $1/4$ to $1/2$ inch of each other, there was sufficient infiltration to conduct the heat properly without blowing the sand onto the ware.

The cars are placed on the angle-iron track, and the column is pushed through the kiln by actuating the jack a few inches at a time. The cycle is regulated by the frequency with which the pushes are made and the distance pushed each time. For a 20-hour cycle, the column is advanced 3 inches every 15 minutes; for a 60-hour cycle, a 1-inch advance is made every 15 minutes. A mechanical pusher, designed to advance the column continuously at a wide range of speeds, will probably replace the manual type.

(2) Changing Temperature

After all of the glazes for any given temperature are loaded into the kiln, a string of empty cars is placed on the track. The number of empty cars will depend on the degree of change in temperature which is contemplated, but it should never be less than enough to extend 7 feet. Following the empty cars, the cars containing ware to be fired at a different temperature are placed on the track and pushed through on the regular cycle. The actual change in kiln temperature is made when the last car of the first series of glazes is far enough beyond the hot zone to be unaffected by such a change. A change of 50°F. may be made safely when the last car has just cleared the burner port nearest the hot zone on the exit side. The first car of ware to be fired at the altered temperature should be at least 1 foot from the hot zone when the change is made, and the distance should be increased if a change of more than 50°F. is contemplated.

(3) Temperature Distribution

To simulate the conditions encountered in a commercial firing, it was necessary to determine the heat distribution throughout the kiln. A standardized noble metal thermocouple in conjunction with a portable potentiometer was used to measure the temperature at different points.

When the furnace had been running at 2200°F. for several hours, the thermocouple was placed through the top of the hot zone at five points about one foot apart, through the ports at each end of the hot zone, and into the ends of the furnace at varying distances. At each of these points, readings were taken at 2, 4, and 6 inches above a car on which the thermocouple

was placed. Inasmuch as the furnace is regulated by a high-low flame controller, there is a variation of 30° to 40°F. between the maximum and minimum temperatures; as the variation, however, occurs over a very short period of time, the extremes cannot be considered to have a serious effect on the ware. After the regulator had turned the flame to low, the temperature of the observed point was read at the time the recording instrument came down to 2200°. The results of this series of observations were plotted in the form of temperature vs. position in the furnace (Fig. 2).

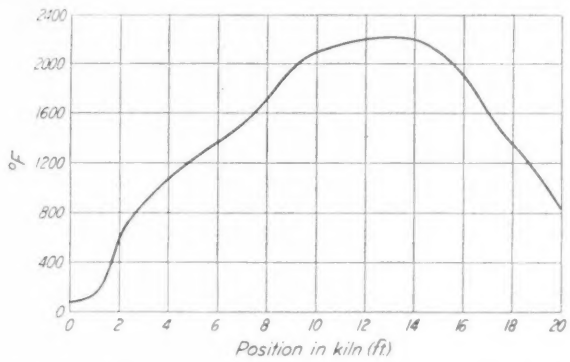


FIG. 2.—Firing curve for continuous kiln; control point set for 2200°F.

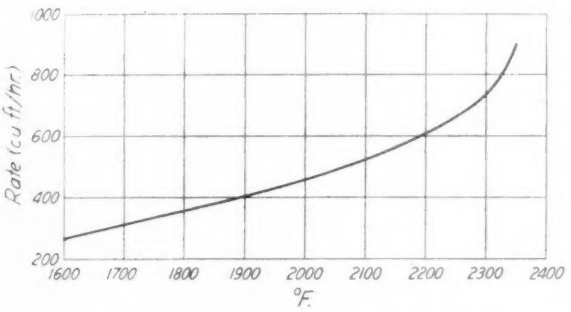


FIG. 3.—Gas consumption in continuous kiln.

An analysis of the results shows that there was less than 10°F. difference in temperature from the top of the car to the top of the tunnel throughout the greater portion of the kiln. At the extreme ends of the kiln, the top was somewhat hotter than the bottom, probably because of convection currents. On very short cycles of five hours or less, there was less uniformity of temperature.

Pyrometric cones, as a check, were sent through the kiln on top of a car and others as close to the kiln top as possible. Observation through the ports indicated like bending of like cones at all positions in the kiln. At the exit end of the kiln, the last cone on each plaque was bent to about 3 o'clock with only 1/4-inch difference between the two. The top cone had bent slightly more than the bottom.

This excellent heat distribution was later proved empirically by close observation of similar glazes fired in different tiers, which were practically always identical in appearance.

(4) Fuel Consumption and General Efficiency

Considering the quantity of ware fired, the kiln is considerably more efficient than any previously used in this laboratory. Figure 3 shows the hourly gas consumption at various temperatures.

IV. Results

The first series of glazes run in the kiln consisted of about 350 compositions of different types that had shown some promise in other types of kilns. Firings were made at intervals of 50°F. from 1650° to 2350°F., inclusive. Each glaze was fired from a point which was thought to be lower than its maturing temperature to a point at which it definitely overfired. The complete results are too detailed to be incorporated in this paper, but they were interesting and instructive. In practically every case in which the glazes failed in the field after having been pronounced usable on the basis of a short fire in a periodic kiln, firing in the tunnel kiln brought out the same defects.

All of the samples of commercial glazes which were tested produced results similar to commercial firings except the high lead glazes that were exposed to direct fire, which blistered badly. It is believed that these defects would be eliminated by saggering the ware, thus retaining a high lead atmosphere to prevent the fumes from boiling out of the glaze. Better results could probably be obtained by loading the kiln with high lead glazes, such as those used in commercial firings.

V. Conclusions

This kiln is an interesting tool, incorporating several novel features of design and construction; it is flexible, and it produces results on a laboratory scale which closely approximate those obtained in commercial firings.

Acknowledgment

The authors wish to acknowledge the helpful suggestions of C. J. Kinzie, Director of Research, and of E. Wainer for his aid in formulating the zircon refractories used in the construction.

TITANIUM ALLOY MANUFACTURING COMPANY
NIAGARA FALLS, NEW YORK

STOKER FIRING OF KILNS*

By J. E. Martin

Abstract

The author discusses (1) the benefits that may be expected from the application of the kiln stoker; (2) a description and illustration of the product; (3) the method of application; and (4) some of the important points to be considered in applying this equipment to each particular plant.

I. Introduction

(1) Heat Distribution

One of the fundamental benefits of the application of stokers to kilns is uniform distribution of heat throughout the kiln which is obtained with greater ease and control than by the use of hand firing. This uniformity has been checked by pyrometer readings at various points in the kiln. A reduction of color variations is also evidence of improved distribution of heat. The ware is fired uniformly all the way to the bottom of the kiln by delayed combustion. Temperature variations have been held to within a fluctuation of 10° of the desired temperature. This compares with normal temperature variations of 50° to 100° when hand firing is used.

(2) Flame Control

The flame length is controlled by varying the primary air delivered by the forced-draft fan.

There are many advantages in having a long flame after the temperature of the kiln has been raised to a point where it will support combustion as the flame passes through the ware. As higher temperatures are reached, a longer flame can be secured.

At one plant, extensive tests were run by the operators, based on the theory that the best results could be secured throughout the entire firing period by having as nearly complete combustion as possible take place in the firebox. Compared with the results obtained with a longer or gas-producer flame, the firing time was about ten to twelve hours longer.

The extent to which the primary air may be cut down and the producer gas flame may be utilized depends to a certain extent on the type of ware being fired. The clear colors require more combustion in the firebox. In other words, with some types of clay or shale it was found that a long flame has a tendency to flash the brick.

(3) Flashing

Flame flashing may be obtained easily with the kiln stoker by reducing the primary and secondary air to the kiln. During this operation, the draft is checked to a minimum.

Zinc flashing may also be handled satisfactorily with the kiln stoker by reducing the coal-feed rate on the stoker when the firing period is completed. The amount of primary and secondary air, furthermore, is reduced as in flame flashing, and the zinc is added to the firebox manually.

II. Benefits from Application of Stokers

(1) Economy

An important benefit, in addition to uniformity in heat distribution obtained by the use of the kiln stoker, is economy, that is, lower fuel cost per firing. This may be accomplished in two ways, namely, (1) the kiln stoker is designed to burn the smaller, less expensive sizes of coal, which in most communities results in a lower cost per ton, and (2) the principle of underfeed firing combined with forced-draft firing used in the kiln stoker results in burning the coal at a higher rate of efficiency than is possible in the average hand-fired kiln; this means that fewer tons of fuel are used to produce the same degree of temperature.

These economies vary in different sections of the country, depending on the market price of coal and on varying factors in the plant itself. In about 90% of the plants equipped with stokers, this economy has been satisfactory to the plant owner. In fact, the resultant economy in most cases has been such as to make the application of the kiln stoker a self-liquidating investment in three to five years.

(2) Improved Quality

In addition to fuel economy, the kiln stoker in almost every application has resulted in an increase in the quantity of No. 1 quality ware, thus increasing the productive value of the kiln.

Other benefits have been (*a*) a reduction in labor, (*b*) a decrease in the amount of time required for one firing, which results in a higher productive capacity from the kiln, and (*c*) the elimination of smoke, which is particularly important if the plant is adjacent to a town or city.

III. Stoker Design

Figure 1 shows the general appearance of a typical kiln stoker of the type under discussion. Although the stoker consists of a number of parts, it is made up of two distinct, self-contained assemblies, namely, the hopper assembly and the furnace assembly. The hopper assembly is made up of the hopper, speed reducer, motor, and fan and feed screw. The furnace assembly consists of the feed tube, air duct, windbox, retort, and grate castings. These two assemblies are held together by four keys which are easily removed or replaced.

* Presented at the Forty-Second Annual Meeting, The American Ceramic Society, Toronto, Canada, April 10, 1940 (Structural Clay Products Division). Received February 10, 1940.

The furnace assembly is permanently installed in the firebox, but the hopper assembly is portable. A ten-kiln plant in which each kiln has ten furnaces and the kilns are fired in rotation, three at a time, would require thirty complete kiln stokers and seventy stoker furnace assemblies. This is enough equipment to mechanize completely the firing on all kilns.

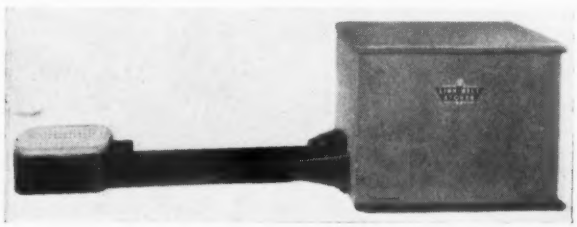


FIG. 1.—Typical stoker design.

The hopper (Fig. 2) is made of heavy gauge, copper-bearing steel and is fitted with a weatherproof lid. The motor, fan, speed reducer, and starting switch are located inside the hopper cabinet, which is weatherproof. The hopper is mounted on a steel-plate base that is equipped with handles for facility in moving it from kiln to kiln.

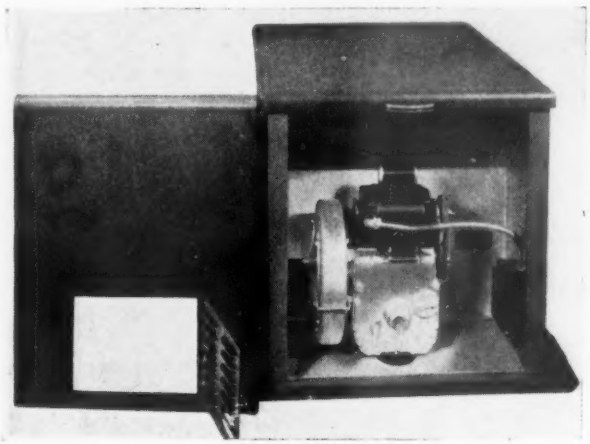


FIG. 2.—Hopper construction.

IV. Method of Application and Operation

(1) Application

There is a lack of standardization both in the number of fireboxes and in the firebox dimensions. The fireboxes are usually long enough for stoker firing and the distance from the floor to the arch ordinarily is sufficient although it is too narrow. These fireboxes therefore are satisfactory for hand firing, but they are too narrow for stoker firing.

A firebox for stoker firing should not be less than 28 inches wide. This width provides sufficient clinker storage space for eight-hour cleaning cycles when a fair quality of coal is used and eliminates the loss of coke when cleaning. Because the wider firebox produces a better diffusion of the gases, the expense connected with the widening of a firebox will be saved through a reduction in brickwork maintenance.

Figure 3 shows an isometric drawing of the stoker as it is applied to an average kiln.

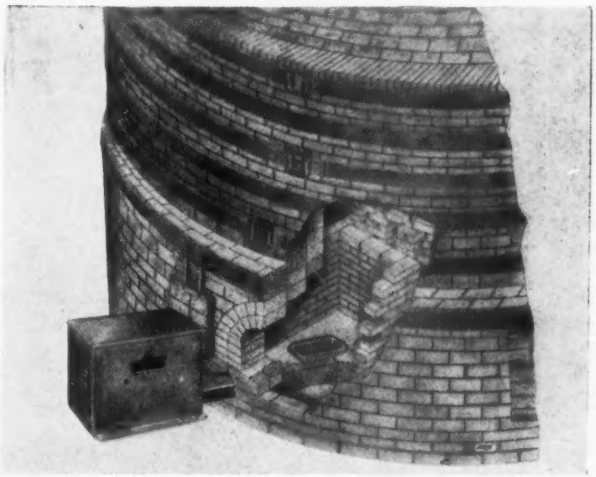


FIG. 3.—Isometric drawing of stoker application.

(2) Operation

The amount of manual labor required to handle the fires is considerably reduced by the application of stokers. Insofar as the control of the firing is concerned, the same degree of skill and intelligence is required as with other methods.

Although the stoker will automatically feed the coal to the fire and the forced draft fan will deliver air, the control of the temperature in the kiln and of the flame are matters that must be handled by the operator, based on his knowledge of the product that is being fired. Experience in a great many plants has indicated that the average fireman adapts himself readily to the technique of stoker firing. Most plant men are capable of handling the operation after instructions are given on the first firing.

STOKER DIVISION
LINK-BELT COMPANY
CHICAGO, ILLINOIS

HIGH-TEMPERATURE GAS-FIRED TEST FURNACE*

By C. L. Thompson and Herman G. Wilcox

Abstract

A high-temperature, gas-fired test furnace, capable of maintaining temperatures above 1725°C., is described. Neither the air nor gas is preheated. Features of the furnace are uniform temperature distribution, ease of control, and quiet operation.

I. Furnace Construction

A high-temperature, gas-fired test furnace, built about two years ago, has given such gratifying results that a brief description of the furnace should be of interest.

The furnace is of conventional downdraft design and has a hearth measuring 2 ft. 6 in. by 3 ft. 4 in. and a height of 2 ft. 4 in. at the center. Firing spaces behind $4^1/_2$-in. flash walls on each side of the furnace increase the total inside width to 4 ft. 2 in. The furnace has a maximum capacity of thirty-nine 9-in. straights set on edge for reheat tests or of about two hundred 9-in. straights set for firing.

The lining, flash wall, floor tile, piers, and all parts subjected to extreme temperatures are built of 90% alumina brick. The crown and side walls are 9 in. thick; in all other parts 90% alumina brick, $4^1/_2$ inch in thickness, are used.

As much insulation was used as seemed practicable, consisting of $4^1/_2$ in. of insulating firebrick of the 2600°F. group backed with $4^1/_2$ in. of insulating firebrick of the 2000°F. group. In the side walls, the outer layer of insulation was cut to $2^1/_2$ in. The use of insulation on such furnaces presents problems in bracing the kiln, which have been met by the use of solid-wall construction behind the buckstays. The angle iron that supports the roof skews is set on these extensions and the inner end of the skews rests on the furnace side wall. The side-wall insulation stops about 2 inches below the skew angle, leaving a cooling space that prevents overheating of the iron.

The door arch used on the furnace has not held up well, but the design, shown in Fig. 1, has been used on a similar smaller furnace built subsequently and seems to solve the door problem. This design lends itself well to end-bracing of the crown, which is necessary to prevent a gradual opening of the rings of the crown.

II. Burner Equipment

The kiln is fired with natural gas without any preheating of air or gas. There are two sets of three burners on each side of the kiln; each set of burners has a capacity of 1000 cu. ft. of gas per hour. McKee universal burners are used, which fit tightly and discharge into refractory burner tunnels that are rammed in place in the furnace side walls. The material used for these burner blocks is a 90% alumina ramming mixture. The air for combustion is supplied by a Spencer turbo-compressor with a capacity of 600 cu. ft. of air per min. at 1 lb. of pressure. The air is supplied by a manifold to a separate McKee proportional mixer for each set of burners. The method of manifolding is shown in Fig. 2. Atmospheric pressure in the gas line to the mixer is maintained by means of a zero governor, and the amount of gas drawn into the mixer is thus dependent on the velocity of the air in the mixer. For a given orifice setting in the mixer, the ratio of gas to air remains essentially constant from about one-fourth to total capacity of the burners. Each set of burners is separately controlled by a blast gate and is equipped with a manometer which simplifies kiln operation. There is a small lighting port in the front wall at each side of the door. These ports are equipped with atmospheric burners so arranged that they may be swung out after the other burners are lighted and the ports may then be closed with brick. These atmospheric burners may also be used for heating at slow rates below the range of the main burners when the kiln is used for firing ware.

III. Furnace Operation

Since the furnace was built, it has been operated on an average of once each week; most of the runs were reheat tests at 1600°C. or higher, with several at 1725°C. There has been no occasion to use the furnace above the latter temperature, but it is certain that the temperature can be brought up to a point somewhat higher because the burners must be turned down considerably during the early part of the period at that temperature. In the reheat tests, the furnace is heated at the standard rate shown in Table I and held at the specified temperature for five hours. In the high-temperature range, the furnace temperature is measured with a recording radiation pyrometer, checked by

Table I
Heating Rate Used in Reheat Tests

Hours	Temperature (°F.)	Temperature (°C.)
Start		
1	1200	649
2	1800	982
3	2200	1204
4	2400	1316
5	2500	1371
6	2600	1427
7	2700	1482
8	2800	1538
9	2900	1593
10	3000	1649
11	3100	1704
12	3150	1732

* Presented at the Forty-Second Annual Meeting, The American Ceramic Society, Toronto, Canada, April 10, 1940 (Refractories Division). Received April 10, 1940.

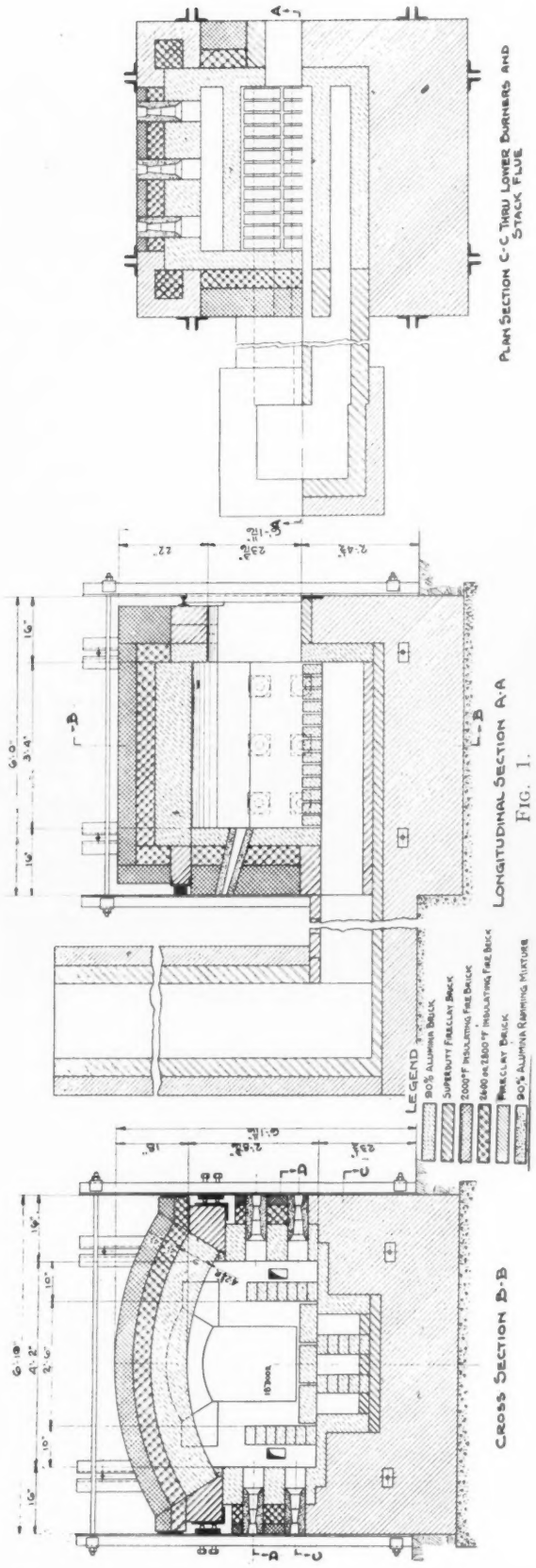


FIG. 1.

optical pyrometer readings. Experience has shown that it is easily possible to hold the temperature at the specified point, with a maximum variation of ±10°F.

In addition to the fact that high temperatures are easily attained, the furnace has other desirable features, such as ease of operation, uniformity of temperature over the hearth, and quiet operation. The operator has only to regulate four blast-gate valves so that there is the same mixture pressure at each side of the furnace and, with a standard heating rate, a definite schedule of turnup is easily established. With the burner tunnels in good condition, the only requirement for uniform temperature distribution seems to be the maintenance of equal pressure of mixture at the two sides of the kiln; several checks with cones distributed over the hearth have shown a maximum variation of about 1/4 cone at

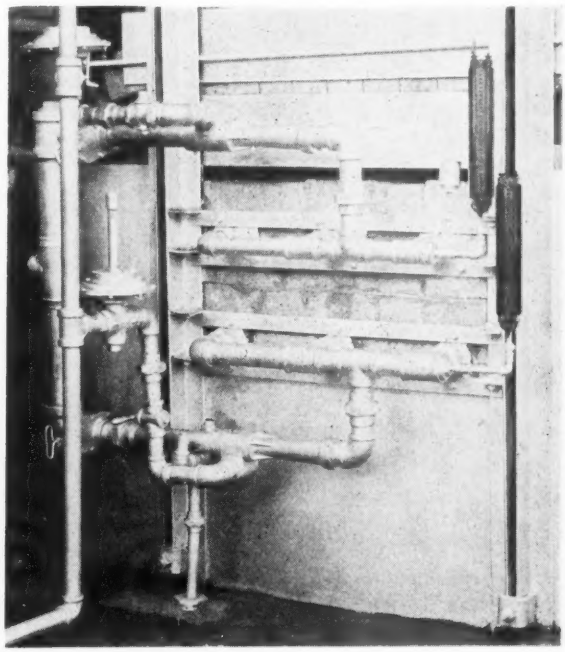


FIG. 2.

cone 30. In contrast to the roar of the usual high-temperature test kiln, fired with high-pressure gas burners or with oil, this kiln can be heard only a short distance away. The blower operates quietly, and there is no irritating roar from the burners even at high furnace temperatures.

Acknowledgment

The authors express their indebtedness to the staff of the Industrial Sales Division, Equitable Gas Company of Pittsburgh, who calculated the heat requirements of the kiln and recommended the gas-burning equipment.

HAYS LABORATORY
HARBISON-WALKER REFRACTORIES COMPANY
HOMESTEAD, PENNSYLVANIA

NOTES ON REFRACTORIES AT NORANDA SMELTER*

By W. B. Boggs

Abstract

The Noranda Smelter treats sulfide ores, concentrates, and siliceous fluxing ores from its own mine and a considerable quantity of siliceous ores and sulfide concentrates from other mines. The ores are roasted in wedge multiple-hearth roasters, followed by smelting in reverberatory furnaces, converting in basic converters, and refining in an anode furnace for the production of anode copper. The use of refractories and changes in furnace construction are discussed.

Noranda is situated about four hundred miles directly north of Toronto in the western part of the Province of Quebec, Canada. The Horne Mine, which is located at Noranda, has a concentrator of 3000 tons per day capacity and a small smelter which handles a maximum 4000 tons of dry charge per day.

The Noranda Smelter treats sulfide ores from the Horne Mine, concentrates from the Horne concentrator, and custom gold and copper concentrates and ores from the surrounding district. The 3000-ton concentrator produces about 500 tons of concentrates a day, the mine supplies 1500 to 2000 tons of direct-smelting sulfide ore, and the remainder of the 4000 tons smelted is made up of custom material. The crushing plant runs 16 hours a day, 6 days a week, and it actually crushes about two million tons a year, of which one million tons go directly to the concentrator.

The smelter proper consists of ten multiple-hearth, wedge roasters, 25 feet in diameter; nine roasters with seven interior hearths and one drying hearth; and one roaster with nine interior hearths and one drying hearth.

There are two pulverized coal-fired, reverberatory smelting furnaces, 27½ by 112 feet inside the brickwork, equipped with three waste-heat boilers. There are four Peirce-Smith converters, two of which are 12 ft. in diameter by 30 ft. long and two 13 ft. in diameter by 30 ft. long. There are two stacks, each preceded by a Cottrell precipitator; each stack is 422 ft. 6 in. high with a rated capacity of 550,000 c.f.m. of gas at a temperature of 450°F. The No. 1 stack carries 1,000,000 c.f.m. and the No. 2, stack 500,000 c.f.m.

When the smelter was originally started in 1927, the roasters were lined with standard fire-clay brick; standard silica brick were used in the reverberatories; the converters were lined with burned magnesite brick; and the anode furnace, which was not built until 1930, originally had a silica-brick flue, roof, and bottom and magnesite side walls.

There have been no essential changes in the type of refractories used in the roasters. The reverberatory refractories, however, after many experiments, have been changed, and very few silica brick are used in the maintenance of the reverberatories. The front wall and firing wall of the reverberatories are built of 60% alumina brick, the side walls, of burned or unburned magnesite brick, and the 70 feet of the arch, beginning with the firing wall, is made of suspended unburned magnesite brick with steel plates between. Fire-clay brick are used in the flues. The converters for the last six years have been lined with unburned magnesite brick, although at the present time some specially burned magnesite brick are being tried out for the back and the tuyère line.

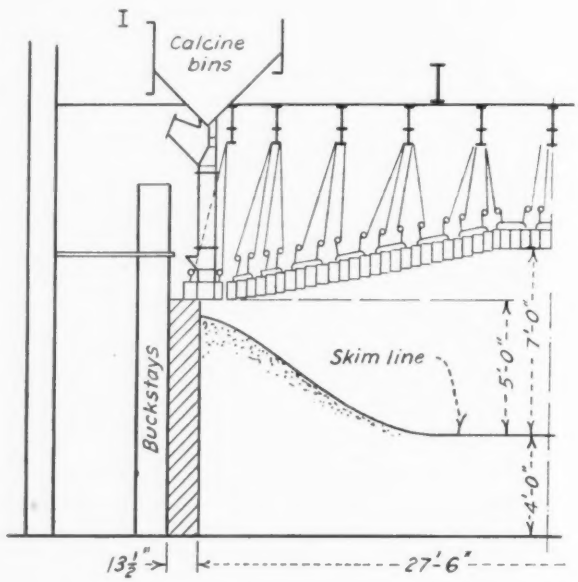


Fig. 1.—Nine-inch magnesite suspended arch.

The last suspended roofs put on the two reverberatories are about 2 ft. 5 in. higher in the center than the original silica sprung arch, and they dip down by steps to the sides to a point 2 ft. higher than the original silica sprung arch. This permits the use of almost 100% more coal than was planned. The furnaces were built originally to smelt about 500 tons of solid charge per day with a fuel ratio of 13%, or 260 lb. of coal per ton of charge, but each furnace now smelts about 1500 tons of solid charge per day with a fuel ratio of 10.4%, or 208 lb. of coal per ton of charge.

The No. 1 furnace has been under continuous fire for seventeen months without a shutdown for repairs

* Presented at the Refractories Division Autumn Meeting, Conneaut Lake, Pa., September 8, 1939. Received September 26, 1939.

except for a general plant shutdown of twenty-four hours, and the No. 2 furnace has been under continuous fire for twelve months without a shutdown.

After a furnace roof is repaired, it generally runs without any attention for about eight months when hot spots are likely to appear in the roof near the firing end. With full fire on, the brick masons stand on top of the rods or pipes which support the suspended roof, cut out the hot spots, and replace them with new brick without interfering with the operation of the furnace.

By patching from time to time in this way, the furnaces can be run almost indefinitely. The side walls above the charge are burned out quite frequently, especially in the first 70 ft. from the firing wall. The brick masons during the past year have evolved the scheme of using large tin cans, 8 in. thick, 15 in. wide, and 30 in. long, which have been previously filled with Magnifrit mixed with a small amount of sodium silicate, to take the place of brick on the side walls. The cans are supported by hookbolts, imbedded in the Magnifrit and hooked on to the skewback on the side of the furnace. By this means, the side walls are suspended and cannot fall into the furnace. After about six months, these burn out and are replaced with new cans while the furnace is under full fire.

cally pressed, unfired magnesite brick inserted in cans. The cans have an extension lug with a hole into which one end of a hook is inserted, and the other end of the hook goes over a pipe. The pipes are supported by long rods from the superstructure overhead. The burned magnesite brick, up to the present time, have not had the same length of life as the unburned brick.

With few exceptions, the steel cylindrical shells of the converters have been lined with the same type of unburned brick with steel plates between the joints. The life of the converter lining has been extended to a maximum of a year by frequently blowing a charge of copper matte without silica so that the iron is oxidized to Fe_3O_4. This magnetite (Fe_3O_4) adheres to the brick and retards its destruction.

The anode furnace, as mentioned previously, was built originally with a silica sprung arch roof and an inverted silica brick bottom. After a few charges, the silica brick bottom came up and the furnace was shut down. The silica brick were removed, the side walls were patched, and a new fused-in bottom was put in, composed of 5 to 10% of roll scale mixed with Magnifrit. This was fused in layers 1 in. thick to an approximate depth of 30 in. The bottom has refined 285,000 tons of copper in eight years without a shutdown for major repairs and it is still in use.

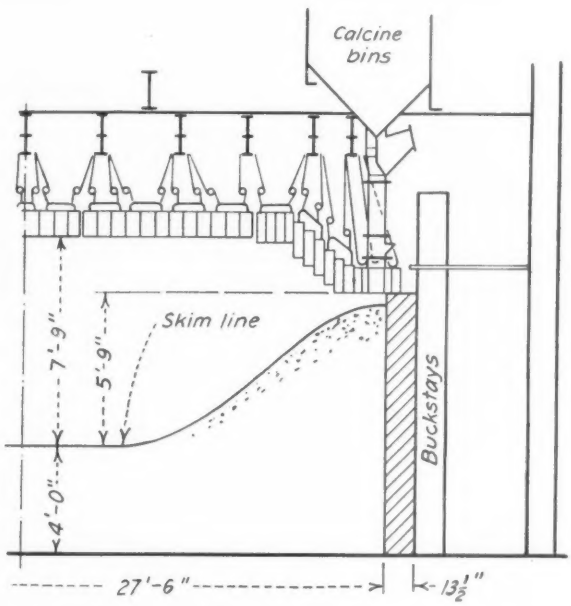


FIG. 2.—Thirteen and one-half inch magnesite suspended arch.

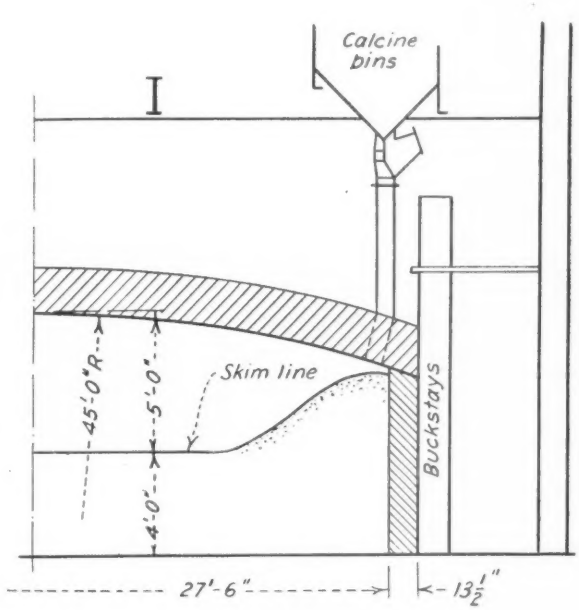


FIG. 3.—Silica sprung walls.

The slag end (the cooler end) of the furnace has a silica sprung arch which lasts for one or two years. It is necessary to shut down the furnace only when this arch burns out. The present plans are to replace this part of the roof with a suspended arch of magnesite and thus to run the furnace indefinitely without shutting down for any repairs. The best results on suspended reverberatory roofs have been obtained when the roofs are made with chemically bonded, hydrauli-

In September, 1938, while a charge of copper was being refined, a section of the bottom came up, and after the charge had been cast, a large hole was found in the fused bottom at the skimming end which extended to the concrete base of the furnace.

The base of the furnace is made of a concrete slab, supported on piers about 3 ft. above ground level. A hole was drilled through the concrete slab, and an oxygen lance was used to penetrate through to the mol-

ten copper, which was allowed to drain into a previously prepared sand bed below and alongside the furnace. While the fire was still on the furnace, the hole was filled with Ramix, a basic refractory ramming mixture. This material was shovelled into the furnace in successive layers. Time for drying was allowed between additions. The remainder of the hole was then filled with a mixture of Magnifrit, roll scale, and chrome-base cement. Finally, four inches of Magnifrit with from 5 to 10% of roll scale was fused in over the entire bottom. This repair took the comparatively short time of two days.

In November, 1938, the capacity of the anode furnace was increased, because, as a result of increased copper production, it was impossible to cast each day's output in one furnace charge. Accordingly, it was decided to lengthen the furnace $5^1/_2$ ft. at the firing end. Before shutting down the furnace, the extension of the concrete base was built. After the shutdown, the walls were extended, a new firing wall built, and a $13^1/_2$-in. inverted arch of fire-clay brick was laid on the concrete base. To fuse in a Magnifrit bottom in the extension would have been a lengthy operation, and to save time, Ramix to a depth of 34 in. was used for the bottom part of the hearth. This material was tamped into place in thin layers, using a molder's ram. When this had been completed, the furnace-arch extension was laid and the fire was put back on the furnace. Finally, a 4-in. surface of Magnifrit and roll scale was fused in on top of the Ramix, using the same procedure of fusion. The furnace was then allowed to cool to a cherry-red heat, a quantity of cold copper was melted on the bottom extension to season it, and normal operation of the furnace was resumed. The total time required to lengthen the furnace was ninety-five hours.

The writer believes that the fused-bottom method of repair and of lengthening the anode furnace by the use of a Ramix bottom are radical departures for the copper refinery industry. The general practice in fusing in this type of bottom is similar to the practice in the open-hearth steel furnaces.

A silica sprung arch was put on the anode furnace in November, 1938, and as portions burned out, the brick masons replaced them with a magnesite suspended roof without shutting down the furnace.

As far as the Noranda Smelter is concerned, the use of silica brick for furnaces is rapidly disappearing. Future furnace repairs on the reverberatories will be almost entirely of burned or unburned magnesite brick except in the firing wall and the front walls, in which high alumina brick will be used. In the immediate future, the anode furnace will be constructed with 100% magnesite except for the flue, which will be of clay brick.

Noranda Mines, Limited
Noranda, Quebec

THE CLAY DEPOSITS OF CALIFORNIA*

By W. F. Dietrich

Abstract

The present status of clay mining in California is reviewed and a summary is given of the development of ceramic raw materials since the publication of a comprehensive survey in 1928.

The clay-producing regions at Alberhill, Lincoln, and Ione continue to provide the greater part of the high-grade clays used in California industries with but minor changes in the varieties of clay produced. The most important of the newer developments are the successful exploitation of flint fire clay, the extensive utilization of decomposed rhyolites and trachytes from the Hart Mountain and other deposits, and the use of talc-clay bodies for pottery, dinnerware, and wall tile in place of flint-clay-feldspar bodies.

I. Introduction

A comprehensive survey of the clay resources of California was published in 1928,[1] based on field work from 1925 to 1927. In 1935, Hartmann[2] and Burchfiel[3] presented a brief review of the status of the industry. Dietrich[4] described clay-mining methods in California in 1929, and Linton[5] supplied additional data in 1936. Burchfiel[6] also described the deposits of nonclay-ceramic materials in California and presented typical analyses of these materials.

* Presented at the Golden Gate Meeting, American Ceramic Society, San Francisco, Calif., August 11, 1939. Received September 30, 1939.

[1] W. F. Dietrich, "Clay Resources and Ceramic Industry of California," *Calif. Div. of Mines and Mining Bull.*, No. 99 (1928); *Ceram. Abs.*, **7** [9] 652 (1928).

[2] M. L. Hartmann, "Ceramic Clays," *Chem. Met. Eng.*, **42** [8] 419 (1935); *Ceram. Abs.*, **15** [1] 37 (1936).

[3] B. M. Burchfiel, "Ceramic Raw Materials," *Chem. Met. Eng.*, **42** [8] 435 (1935); *Ceram. Abs.*, **15** [1] 37 (1936).

[4] W. F. Dietrich, "Clay Prospecting and Mining in California," *Trans. Amer. Inst. Mining Met. Engrs.*, **76**, 413–29 (1928); abstracted in *Mining & Met.*, **9** [261] 410–11 (1928); *Ceram. Abs.*, **7** [11] 793 (1928).

[5] Robert Linton, "Clay Mining in California," *Mining & Met.*, **17** [352] 198–200 (1936); *Ceram. Abs.*, **15** [6] 188 (1936).

[6] B. M. Burchfiel, "Ceramic Materials Other Than Clays Abundant in California," *Mining & Met.*, **17** [357] 441 (1936).

The purpose of the present paper is to summarize the changes and developments in the production and utilization of ceramic raw materials in California during the past twelve years.

II. Statistics of Production

The rapid growth of the ceramic industry in California reached a peak during the years of 1925 to 1928. In the early years of the depression, many plants were completely closed, and most of the surviving manufacturers even yet possess production facilities greatly in excess of requirements. The severe effect of the depression on the annual value of crude clay sold by producers is shown in Table I and in Fig. 1.

The production of common brick in California reached a peak in 1923 with a production of 397,754M brick valued at $5,194,527. Since 1923, the production declined gradually until 1930, then broke sharply in 1932, reaching a minimum in 1934 of 46,795M valued at $515,407, the lowest in the history of production records, which began in 1893. Production has gradually increased since 1932 to 122,676 M valued at $1,301,825 in 1937.*

Table II and Fig. 1 give the annual value of all ceramic products in the United States and in California and the relative position of California among the states from 1918 to 1937. The annual production for 1932 was the lowest since 1900 in the United States, and the 1933 figure was the lowest in California since 1918.

III. Technological Developments

The acute competitive conditions that have prevailed in the ceramic industry in recent years have not been without beneficial effects, as they have forced all of the successful manufacturers to scrutinize closely their production processes and market opportunities in order to curtail production costs and also to make improved products or create new products to attract consumer demand. In addition to competitive incentives, certain contemporaneous influences have affected the trend of product development. Changes in the building codes of many cities in the earthquake belt, following the Long Beach earthquake in 1933, have led to the development of modified forms of construction and surfacing materials, and more severe standards for high heat-duty firebrick[7] have encouraged the search for high-grade fire clay and the development of firebrick to meet the present specifications.

In the field of raw materials, the urge for lowered production costs with improvement in quality of product has had several important results. For example, in the manufacture of sewer pipe and similar products, the desire to improve quality and to decrease firing costs has led to a more extensive investigation of low-vitrifying, red-firing surface clays with the result that a

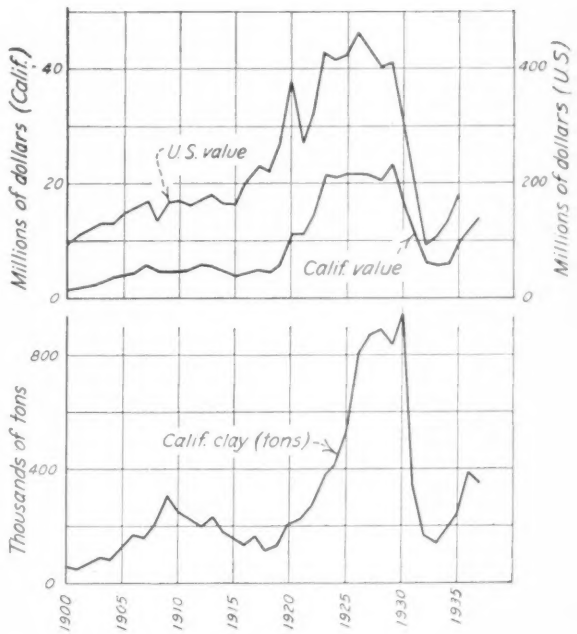


FIG. 1.—Statistics of California clay industry; annual value of clay products.

* All data in this paragraph are from Calif. Div. of Mines reports.

Manual of A.S.T.M. Standards on Refractory Materials, "Standard Definitions for Fireclay Refractories C 27–37," pp. 96–97 (November, 1937).

TABLE I

POTTERY CLAY PRODUCTION OF CALIFORNIA, 1918–1937*

Year	Short tons	Value	Year	Short tons	Value
1918	112,423	$ 166,788	1928	887,807	$ 1,394,950
1919	135,708	245,019	1929	839,949	1,127,527
1920	203,997	440,689	1930	938,586	795,517
1921	225,120	362,172	1931	332,680	408,931
1922	277,232	473,184	1932	167,284	204,890
1923	376,863	697,841	1933	141,629	211,711
1924	417,928	651,857	1934	190,510	245,900
1925	537,587	674,376	1935	240,014	377,969
1926	801,461	806,509	1936	382,823	649,920
1927	867,419	872,661	1937	354,669	705,200
Total since 1887	7,578,203	$9,315,304		11,186,735	$14,562,158

* *Calif. Div. of Mines Bull.*, No. 116, p. 76 (September, 1938). The original table includes data since 1887, which are reproduced in full for 1887–1926, inclusive, in *Bulletin* No. 99, p. 34.

number of plants have developed body mixes that mature at considerably lower temperature than was formerly possible.

In the production of white tile and pottery bodies, the extensive use of talc, bentonitic clays, and decomposed rhyolites and trachytes, all produced in California or nearby areas in Nevada, has simplified and cheapened the cost of producing such bodies and has made the California industry virtually independent of raw materials from other sources of supply, except for limited quantities of the better grades of ball and china clays which are now being obtained from Kentucky, Florida, and other American sources. The use of English clays is decreasing generally in this area.

The cost of ceramic feldspar and flint has been materially decreased in California by the utilization of local deposits of these materials. The deposits are sufficiently large and numerous to supply local demands, and their use is gradually increasing.

The remarkably pure feldspathic beach sands from near Del Monte are being utilized to a limited extent by glass companies and other manufacturers of ceramic products.

The use of nepheline syenite, especially in vitrified ware, is probably increasing although it is quite small at the present time.

IV. Present Sources of Ceramic Raw Materials

Since 1927, no new deposits of high-grade clays have been discovered, but a number of properties that were in the prospect stage at that time have since been extensively exploited, and there has been some change in the varieties of clay being mined from the older producing areas. The Alberhill district in Riverside County, 80 miles southeast of Los Angeles; the Ione district in Amador County, 40 miles southeast of Sacramento; and the Lincoln district in Placer County, 30 miles northeast from Sacramento, continue to produce the greater part of the high-grade clays used in California.

(1) Alberhill District

In the Alberhill district, the principal producers in recent years have been the Alberhill Coal and Clay Company, the Los Angeles Brick Company, and the Emsco Clay Company, operating the Harrington pit.

The Alberhill Coal and Clay Company produces a greater variety of clays than any other single operator in the State and also mines clay on contract for certain manufacturers who own or lease their own deposits. Nearly thirty distinct varieties of clay are available from the Company property, including plastic and nonplastic red- and buff-firing clays for heavy structural ware, terra cotta, tile, and pottery, as well as some excellent fire clays and a limited supply of bone clay. The white-firing china clays (E-101) and (E-102), the SH-3 ball clay, and one or two other varieties reported in 1928 are not available at present, but several new varieties have been discovered, particularly of the buff- and red-firing, low-vitrifying types. The most important of the new varieties are described.

The red-mottled No. 1 clay,[8] an important variety used a number of years ago, was thought to be worked out, but new deposits have been discovered. This is a red-firing, plastic clay and is extensively used in roofing-tile bodies.

[8] (*a*) E. S. Boalich, *et al.*, "Clay Industry in California," *Calif. State Mining Bur. Preliminary Rept.*, No. 7, p. 82 (1920).

(*b*) J. H. Hill, "Clay Deposits of the Alberhill Coal and Clay Company," *State Mineralogist's Rept.*, **19**, p. 208 (1923).

TABLE II

TOTAL VALUE OF ALL CERAMIC PRODUCTS IN CALIFORNIA AND IN THE UNITED STATES FROM 1918 TO 1937*

Years	Value	No. of producers	Rank among states	Percentage of total U. S. value	Value	No. of producers
1918	$ 4,329,220	68	11	2.00	$221,884,651	2783
1919	5,834,648	66	10	2.10	275,346,378	2776
1920	10,946,423	65	9	2.9	373,670,102	2716
1921	11,172,491	63	8	4.1	270,738,536	2449
1922	14,689,830	62	6	4.6	321,494,403	2098
1923	20,833,053	86	6	4.9	424,582,628	2441
1924	20,994,732	86	6	5.0	415,779,378	2353
1925	21,324,844	99	6	5.0	423,446,917	2417
1926	21,651,327	95		4.6	459,049,470	2391
1927	21,417,713	111	6	4.9	433,487,316	2173
1928	20,462,618				400,694,078	
1929	23,159,666	133	5	5.7	408,501,690	2073
1930	16,219,995				301,442,498	
1931	10,560,000	93	7	5.5	193,201,730	1539
1932	6,463,659				96,251,000	
1933	5,487,000	70	6	5.1	108,320,921	1159
1934	5,902,964				132,175,463	
1935	9,680,355	81	5	5.4	177,974,841	1331
1936	12,127,114					
1937	14,391,761	83				

* Data have been obtained from the following sources: 1917–1920, U. S. Geol. Survey; 1921–1926, U. S. Bur. Mines, Mineral Resources; odd-numbered years 1927–1935, U. S. Bur. of Census; U. S. data, even-numbered years, 1928–1936; and for 1937, Calif. Div. of Mines. The Calif. Div of Mines data do not check exactly with the Bureau of Census figures because of differences in compilation methods. Data from 1896 to 1926, inclusive, are shown in the *Calif. Div. of Mines Bull.*, No. 99, Table VII, p. 36.

A new variety of plastic buff-firing clay, No. 4 plastic, tightens at cone 04 and has a P.C.E. of 26. It is used as a tightener for the high heat-duty firebrick. The known thickness of this deposit is seventy-five feet.

A variety of red-firing plastic clay, No. 3 shale, has been extensively mined for use in sewer-pipe bodies.

The Los Angeles Brick Company is still using the same varieties of clay reported in 1928,[9] which in general are similar to those being mined from other properties in the district. Several additional deposits of bone clay have been discovered, one of which is said to contain nearly 60% of Al_2O_3. Good bone clays are relatively scarce in California, making these discoveries of special interest.

The Harrington pit of the Emsco Clay Company has been extensively exploited in recent years, and the deposit has proved remarkable for the uniformity and extent of the various clay strata. The chief varieties include plastic fire clays and red-firing plastic sewer-pipe, face-brick, and roofing-tile clays.

The Gladding, McBean, & Company plant at Alberhill has been idle for a number of years, but clay mining on the property has continued to supply other plants of the Company in the Los Angeles area.

(2) Lincoln District

The clays of the Lincoln district are owned and exploited by three companies, the Clay Corporation of California, Gladding, McBean, & Company, and the Lincoln Clay Products Company.[10] The more important varieties of clay from the district are classed as plastic refractory clays and are characterized by good plasticity, high drying and firing shrinkage, relatively low vitrification range, and high fired strength. They have been used extensively in the manufacture of firebrick, stoneware, terra cotta, ceramic veneer, and faience tile.

The less refractory varieties are used in roofing tile, firebrick, sewer pipe, and similar applications.

There have been no essential changes in recent years in the varieties of clay produced from the district, and there is ample evidence of an adequate supply of these varieties for many years to come.

(3) Ione District

The principal clay producers in the Ione district are M. J. Bacon, the Clay Corporation of California, and the Ione Fire Brick Company. The district has long been noted for the production of fire clays and fire sands of exceptional quality, which are widely used in the manufacture of refractories, faience tile, and related products. A number of buff- and red-firing plastic clays have also been extensively used.

The Ione district is one of the few sources of supply in California for plastic fire clays with a P.C.E. of 33 to 34 or higher. The fire sands consist of a mixture of from 30 to 90% of fine-grained silica sand and 70 to 10% of refractory clay.

Increased costs of underground mining, largely caused by the increasing stringency of accident-prevention regulations and high industrial accident insurance rates, have forced the abandonment of the Shepard sand pit,[11] formerly one of the principal sources of fire sand. To replace this source of supply, Mr. Bacon is developing other pits that can be mined by surface methods, particularly the Tony pit, about two miles southeast of Ione, in which there is a layer of sand up to thirty feet in known thickness.

A new deposit of cones 33 to 34 fire clay has been opened up by Mr. Bacon at Chalk Hill, about two miles northwest of Ione. This deposit shows promise of a material increase in the known reserves of this type of clay.

The "B" pit, a short distance north of Ione on the Ione-Carbondale road, is another recent development. This deposit is known to contain about 100 feet of clay, consisting of several varieties, including a "calsomine" clay, a "chocolate" clay, and a good fire clay. The "calsomine" clay (B-3) is used as a substitute for kaolin in nonceramic applications when a pure white color is unnecessary. Its chief use is as an extender in adhesive and pigments. It is shipped to the Industrial Minerals Company of Berkeley for grinding to trade specifications. The "chocolate" clay (B-4) is similar to a clay of the same name previously described[12] and has a P.C.E. of 33, but the shrinkage is exceptionally high. The fire clay (B-5) is a plastic variety with a P.C.E. of 31 to 32 and is being successfully used in firebrick.

One of the best fire clays of the district is the Edwin clay from the Jones Butte property,[13] leased by the Clay Corporation of California, a subsidiary of the Stockton Fire Brick Company. The original operations on the west side of the hill have been abandoned, but three other underground operations are in production on the east side. One of these is entered by a shallow incline shaft equipped with a hoist, and the others are entered by adits. Underground mining is by the room-and-pillar method, using timber where it is necessary to support the roof. These developments have insured a good supply of cone 34 fire clays for a number of years.

(4) Other Districts

At present, the most interesting developments outside of the three principal districts are at Claymont and the Santa Margarita or O'Neill ranch in Orange County, at Hart in San Bernardino County, and at Cooperstown in Stanislaus County. A brief description of these deposits follows.

(*A*) *Claymont Flint Fire Clay:* The Goat ranch property[14] owned by the Gladding, McBean, & Company is now known as the Claymont property. It is located near the eastern boundary of Orange County on the southerly slopes of Santa Ana Canyon, nine miles west of Corona. The property includes the only known source of high-grade flint fire clay in California, and the successful exploitation of the deposit is one of the outstanding developments of the California ceramic

[9] See reference 1, pp. 174–76.
[10] *Ibid.*, pp. 147–58.
[11] *Ibid.*, p. 54.
[12] *Ibid.*, p. 57.
[13] *Ibid.*, p. 53.
[14] *Ibid.*, p. 141.

industry in recent years. The flint fire clay has a P.C.E. of 34. The geology of the deposit and the ceramic properties of the clays have been described.[15] In addition, a refractory shale (P.C.E. of 29) has been extensively mined.

(*B*) *Santa Margarita Ranch Fire Clay:* The Santa Margarita ranch clay deposits from San Juan Capistrano in Orange County[16] are now being operated by the Tierra Colorado Company, a subsidiary of the Vitrefrax Corporation of Los Angeles. High-grade fire clays are produced, which are used in the manufacture of high-heat and superduty firebrick, as well as excellent clays of lower refractory qualities.

(*C*) *Hart Clay:* Several operators are mining clay from the Hart Mountains in the extreme eastern part of San Bernardino County. The plastic varieties, previously described,[17] have proved difficult to use successfully on a large scale; the supply of these varieties apparently is limited and the occurrence is erratic, but attention has been directed toward the less plastic varieties which have a chemical composition closely related to porcelain and are finding increasing use among whiteware manufacturers throughout the State. The best-known deposit is that of the Standard Sanitary Manufacturing Company, and another of the varieties is being ground and marketed by the Southern California Minerals Company of Los Angeles, which has leased the Coors deposit.

The Hart clays are derived from the alteration of rhyolites or trachytes, probably the former. Deposits of similar material are reported from various localities in the Mojave Desert, but no data are available on these occurrences at this writing.

(*D*) *Cooperstown Sagger Clay:* Near Cooperstown, Stanislaus County, J. H. Hornsby of Pittsburg, California, has located a deposit of sagger clay that has been widely used in clayworking plants in northern California. Consumers report it to be one of the best sagger clays that has been discovered in California. It has good plasticity and little shrinkage up to cone 13. The deposit is apparently of considerable extent.

(*E*) *PV Clay:* This material, also known as potter's clay and plastic Vitrox, is now produced by the American Minerals Company of San Pedro. The deposit is located in Jawbone Canyon, about 20 miles north of Mojave. The mineral is probably a decomposed trachyte and occurs in large quantities of a high degree of uniformity. It is used extensively in the production of high-grade roofing granules, as well as in porcelain, pottery, and wall-tile bodies.

Department of Mining and Metallurgy
Sacramento Junior College
Sacramento, California

[15] B. M. Burchfiel and Henry Mulryan, "Flint Clays and Flint-Clay Refractories of Southern California," *Bull. Amer. Ceram. Soc.*, **19** [5] 161–63 (1939).

[16] See reference 10, p. 145.

[17] (*a*) *Ibid.*, pp. 194, 196, 264.

(*b*) W. F. Dietrich and W. W. Meyer, "Investigation of Possible Use of Certain California Clays in Vitreous China Sanitary-Ware Bodies," *Jour. Amer. Ceram. Soc.*, **13** [3] 202–17 (1930).

CERAMIC HISTORY

EDWARD RAY WEIDLEIN

Director of Mellon Institute, Pittsburgh, Pennsylvania

Edward Ray Weidlein, scientist, inventor, author, and director of Mellon Institute, 4400 Fifth Avenue, Pittsburgh, Pennsylvania, with which institution he has been prominently and actively identified for twenty-five years, was born July 14, 1887, at Augusta, Kansas. He is a son of Edward Weidlein, who is an oil producer at Augusta, Kansas, and of the late Nettie (Lemon) Weidlein. His ancestry on his father's side is German; his mother was of Scotch-English descent.

Dr. Weidlein was educated in the public schools of Augusta, Kansas, supplemented by a professional course at the University of Kansas, Lawrence, Kansas, wherefrom he was graduated in 1909 with the degree of B.A.; in 1910 he received the degree of M.A. from the same University. In 1924, Tufts College, Boston, Mass., conferred on him the honorary degree of Doctor of Science; in 1930, he received the honorary degree of Doctor of Laws from the University of Pittsburgh; in 1937 he was awarded the honorary degree of Doctor of Science by Rutgers University, New Brunswick, N. J.; and in 1939 he received the honorary degree of Doctor of Science from Waynesburg College, Waynesburg, Pa.

Shortly after the completion of his collegiate training he was appointed an Industrial Fellow and conducted, during the period December 1, 1909, to March 1, 1910, at the University of Kansas, a broad study of camphor, under the direction of Robert Kennedy Duncan, the founder of the Industrial Fellowship System. From March 1, 1910, to October 1, 1912, Dr. Weidlein carried out a comprehensive research on the ductless glands, during the course of which he investigated epinephrin from the whale. He then joined Dr. Duncan in Pittsburgh, subsequent to the transfer of the Industrial Fellowship System from the University of Kansas to the University of Pittsburgh; and from October 1, 1912, to October 1, 1916, he was a Senior Fellow of Mellon Institute, having charge of all the institution's investigations in the metallurgy and hydrometallurgy of copper and having supervision of the experimental plant at Thompson, Nevada, where he was located for about four years. In connection with this investigatory work, Dr. Weidlein developed an economically important process for the use of sulfur dioxide in hydrometallurgy.

On July 10, 1916, Dr. Weidlein came to Mellon Institute as Assistant Director; on October 1, 1916, he was

appointed Associate Director, and he was Acting Director throughout the World War, during the leave of absence of Col. Raymond F. Bacon as Chief of the Technical Division of the Chemical Warfare Service, A.E.F. On March 12, 1918, Dr. Weidlein was appointed chemical expert for the War Industries Board, whereon his activities received the highest official commendation.

On October 8, 1921, Dr. Weidlein was made Director of Mellon Institute, and since then he has devoted his exclusive time and attention to the duties of that office. He is also Vice-President of the Board of Trustees of the Institute as well as a Trustee of the University of Pittsburgh, with which the Institute is allied cooperatively.

Dr. Weidlein was made Division Executive of the Chemical and Allied Products under the Raw Materials Division of the Council of National Defense on June 4, 1940.

The eighty Industrial Fellowships or scientific investigations of important "long-time" problems of manufacturing in operation at Mellon Institute cover much of chemical and physical technology, and Dr. Weidlein maintains active contact with these researches. He has in fact had this intimate relationship with the Industrial Fellowship System since its formation in 1907, when he was an undergraduate at the University of Kansas. Mellon Institute, which is an independent, noncommercial organization, also conducts broad investigations in the pure physical sciences, especially chemistry, and sustains other researches elsewhere, particularly medical studies in hospitals, also for the benefit of the professions concerned and the public.

Dr. Weidlein is the author of a large number of scientific papers and articles on industrial research achievements, opportunities, and procedures, and (joint with William A. Hamor) of two popular treatises entitled Science in Action (a book that describes industrial research methods and successes) and Glances at Industrial Research (a comprehensive, compact, authoritative, readable account of the recent advances, present status, and future opportunities of industrial research, as discerned at Mellon Institute).

Dr. Weidlein is an honorary member of the Pittsburgh Academy of Science and Art; the Chemical Metallurgical and Mining Society of South Africa; and the Institution of Chemical Engineers of Great Britain. He is a member of the Guild of Brackett Lecturers at Princeton University.

He is a member of the American Institute of Chemical Engineers (director, 1924; president, 1927–1929; director, 1929); the American Chemical Society (chairman of the Pittsburgh Section, 1923; councilor, 1924–1929; vice-chairman of the Division of Industrial and Engineering Chemistry, 1924; councilor-at-large, 1929–1934; president, 1937; director, 1938–1941); the Society of Chemical Industry (member of the Executive Committee of the American Section; awarded the Chemical Industry Medal for 1935); the Newcomen Society; the Electrochemical Society; Société de Chimie Industrielle; Société Chimique de France; Deutsche Chemische Gesellschaft; Engineers' Society of Western Pennsylvania; Franklin Institute; Washington Academy of Sciences; Kansas Academy of Science; New York Academy of Sciences; American Academy of Political and Social Sciences; National Institute of Social Sciences; Pennsylvania Academy of Science; American Association for the Advancement of Science (fellow since 1925; member of Council, 1934–1942); American Institute; Division of Engineering and Industrial Research, National Research Council (member-at-large); National Education Association; the Pennsylvania Society; the Faraday Society; Pennsylvania Committee of the National Anti-Syphilis Committee; and the Board of Directors of the Pittsburgh Convention and Tourist Bureau.

He is also a Fellow of the American Institute of Chemists and of the Royal Society of Arts of London. He received the Pittsburgh Award on February, 1940.

He is a member of the following fraternities; Pi Upsilon, Sigma Xi, Phi Lambda Upsilon, Alpha Chi Sigma, Sigma Gamma Epsilon, and Sigma Tau.

He is also a member of the University Club of Pittsburgh (president, 1931–1933); Pittsburgh Club; Oakmont Country Club; Chemists' Club of New York; Duquesne Club; Faculty Club of the University of Pittsburgh (president, 1923); Authors Club of Pittsburgh; Pittsburgh Chamber of Commerce; Director, Allegheny County Council West of the Boy Scouts of America; and a 32nd degree Mason.

He is a Trustee of the East End Christian Church of Pittsburgh and of Shadyside Academy and a Director of the Forbes National Bank of Pittsburgh.

Dr. Weidlein was married April 24, 1915, to Miss Hazel Butts, of Wichita, Kansas, and they are the parents of Edward Ray Weidlein, Jr., Robert Butts Weidlein, and John David Weidlein. In politics he is Republican. Principal recreations: golf and hunting. Residence: 325 South Dallas Avenue, Pittsburgh, Pa.

THE CINCINNATI POTTERY CLUB

By Clara Chipman Newton

Presented at opening meeting of the Art Department of the Cincinnati Woman's Club on November 12, 1894.

Owing to a disappointment in obtaining a paper that was to have been the first of a series on what the women of Cincinnati have done to develop the art interests of the city, I have been asked by the chairman of the Art Department of the Cincinnati Woman's Club to incorporate in this paper some of the facts relating to this early art history.

Cincinnati Academy of Fine Arts in 1838

We are told that on October 18, 1838, an institution known as the Cincinnati Academy of Fine Arts was founded, having for its object "the mutual improvement of the members of the various departments of the fine arts," and its membership seems to have been made up both of artists and amateurs. Regular meetings were held for practice in drawing, modeling, and painting. In order to gain funds for the purchase of casts from the antique and other objects worthy of study, an exhibition of paintings, busts, and other art pieces was opened. On the Committee of Arrangements for the first exhibition we find the names of Tanus H. Beard and Minor F. Kellogg.

Western Art Union, 1847–1848

The next society was the Western Art Union, incorporated by an Act of Legislature, 1847–1848. We read, "The object of this institution is the encouragement of the fine arts; every subscriber of five dollars a year is a member for one year and is entitled to a copy of a highly finished engraving, the published annual proceedings, and the addresses at the yearly distributions. All of the funds of the Society, after paying the expenses, will be devoted to the purchase of American works of art, painting, sculpture, etc., which will be publicly distributed by lot among all members the first Monday of November of each year." Among the officers and directors we find the names of Mr. Thos. Longworth, Mr. Anderson, Mr. Griffin Taylor, Mr. Shoenberger, and others equally well known.

Ladies Academy of Fine Arts, 1854

The Ladies Academy of Fine Arts comes next in order of time, founded in 1854, under the intelligent leadership of Mrs. Sarah Peters. It was intended to advance the cultivation of taste. Helen Evertson Smith in an article on "Women as Art Patrons" says, "To give to this band of Cincinnati women the credit which is their due, it must be borne in mind that it was not until three years later than this—in 1857, namely, that even in England the idea of art applied to industrial pursuits crystallized under the fostering care of the Prince Consort into the grand institution known as the South Kensington Museum. Yet in one of the earliest appeals of the Cincinnati Academy of Fine Arts, it is stated that 'a part of the plan of the gallery is the establishment of the School of Design, wherein art may be taught as an occupation and from which genius and skill may go forth with the means of obtaining an honorable livelihood by the exercise of their accomplishments and tastes.'"

The sum of five thousand dollars was raised and Mrs. Peters was commissioned while in Europe to purchase paintings, chiefly copies from the old Masters. With one thousand dollars subscribed by Mr. Andrew McMicken, she bought a number of casts. These pictures and casts were given later to Mr. McMicken for the University of which he was the founder. The gift was stored for safe keeping until the year 1868, when the School of Design was opened in connection with the University. Later, when the School of Design became the Art Academy, and under the direction of the Art Museum Association, the pictures were placed in the Museum. The catalogue of these casts now in the Art Academy includes the Venus of Milo, Diana and the Stag, Apollo Belvedere, Silenus and the infant Bacchus, the Venus de Medicis, and the Wrestlers. It is unquestionably true that the work of Mrs. Peters and her associates left its influence for good on the community.

Women's Centennial Committee, 1874

From the time of the turning over of the casts and pictures to Mr. McMicken for the School of Design, the women of Cincinnati took no prominent part in art work until October 29, 1874, when the Women's Centennial Committee was organized. It is needless to repeat here the well-known history of this organization. With it sprang into life in our midst an industry that has grown and strengthened with years.

In the early summer of 1874, Mr. Benn Pitman, at that time deeply interested in establishing a wood-carving department in the School of Design, returned from a visit to Philadelphia, bringing with him a number of China colors. He invited several of his wood-carving pupils to his office in the Carlisle Building, and at his own expense employed a young German lady as a teacher. Miss Egger had a limited knowledge of the art of mineral painting, and the class

Anniversary Exhibits of Cincinnati Pottery Club Artware

of ignorant but enthusiastic workers, with but little guidance, studied matters out, each after her own fashion. At least two of the pupils present then are here today, Miss McLaughlin and myself. I do not remember Miss McLaughlin's early efforts; my own masterpiece was a tile painted in monochrome, design lobelia, color selected, for some unknown reason, brown instead of blue. As a botanical study it was painstaking; as a work of art—well, my Mother prized it, moved it with her household goods to Denver, and reproached me with feeling when, during my last visit to the far west, I accidentally broke it.

Teacups for Centennial Tea Party

During the winter of 1875–1876, it was decided that in the Spring a Centennial Tea Party should be given in the old Sangerfest Hall, which stood on the site of and was indeed the mother of our present Music Hall. It was proposed that the committee in charge should furnish teacups for the young and aspiring mineral painters to decorate.

Off the large hall in the College building where Mr. Pitman held his classes was a small room which a few of us took possession of. Miss Clara Fletcher, Miss McLaughlin, Miss Holabird, and I were to be found here every class day. We brought our china paints and began experiments on the teacups mentioned. We were soon notified that the School of Design authorities objected to our work; we were unconsciously infringing rules. The cups had to be painted. Miss Fletcher came to the rescue and offered her room which had a fine north light, so that all of the work of our little coterie was done under the shelter of Mrs. Frederick Huntington's hospitable roof. I remember even in those days that Miss McLaughlin dashed at her work, and the head of George Washington, with an exceedingly jaundiced complexion from overuse of yellow, was rapidly succeeded by the pink and white that greater experience in the use of colors enabled her to impart to the countenance of Madam Washington and other stately beauties of the period.

Miss Fletcher painted some cherries, and as a touching tribute to that noble tradition of the truthfulness of the Father of our Country, gracefully entwined a hatchet some place in the decoration. I, with a marvelous patience, rubbed out, painted in, and rubbed out again to such an extent that I had two teacups to show as the result of the labor of three days each week for three months. A Rhode Island dignitary, passing through the city, bought one of these precious productions. The other was sold at auction to the highest bidder, and the bidding was very high, I can assure you. I know that an improved copy of the jaundiced first President sold for twenty-five dollars. The cups and saucers were fired by Gustav Hartwig, a practical decorator located on West Fifth Street. At some future day, time will have made these cups historic; they will undoubtedly become very valuable as they will hold in collections the position of the first china decorated by women in the United States—women who numbered among their number Miss McLaughlin and Mrs. Maria Longworth Storer. The thirty-five teacups that formed the collection sold for the sum of three hundred and eighty-five dollars.

There were several ladies outside of our own little set engaged in the work, and a collective exhibit was sent to the Cincinnati Department in the Woman's Building in Philadelphia, where it won for Cincinnati the reputation that it was the proud privilege of the Cincinnati Pottery Club to maintain in Chicago during the Columbian Exhibit.

Miss McLaughlin's "Under-the-Glaze" Painting

The three years between 1876 and 1879 came and went. In the meantime Miss McLaughlin, incited by the Haviland exhibit of the Limoges faience at the Centennial, began to experiment in "under-the-glaze" painting. The first success was attained in 1877, and the articles produced were exhibited in the Loan Collection, which was held in the Cochonower House on West Seventh Street under the auspices of the Woman's Art Museum Association, for you all know that the Woman's Centennial Committee had reorganized and become the Association that thought of and gave the first impulse to the Art Museum, now so triumphant an institution.

The pieces of ware exhibited by Miss McLaughlin created great interest. Mrs. Aaron Perry in an article contributed to the *Harpers Magazine* in May, 1881 wrote, "It is said that unsuccessful efforts have been made in different parts of Europe to imitate the faience of Limoges. However this may be, there is no doubt that in the United States we are indebted to the intelligence and persistence of Miss McLaughlin for its accomplishment."

Tempted by the success achieved, other women began experimenting in the same direction. Soon in our midst the seed sown began to assume the form of a new industry. The late Mr. Frederick Dallas opened the doors of the Hamilton Roads Pottery, and it was invaded by eager workers.

Miss McLaughlin's first experiments were made at the Coultry Pottery. The first successful vase drawn from the kiln, period 1877, was lent by Miss McLaughlin and formed an interesting feature of the Historical Exhibit at the Cincinnati Room at the Columbian Exposition in Chicago. It has been given by Miss McLaughlin to, and now forms part of, the Historical Collection that is being made for the Pennsylvania Museum under the intelligent leadership of Mr. Edwin A. Barber, the curator of the Department of Pottery and Porcelain.

It is deeply regretted by those who feel the importance of the preservation of these early specimens of work, while there is yet time to make an intelligent record of their order, that the work of collecting them has been undertaken in Philadelphia and not by the directors of our own Museum, where so much of it properly should belong as a matter of local pride as well as of historical interest.

Cincinnati Pottery Club, 1879

On the first day of April, 1879, Miss Holabird opened her home on Fourth Street near John, and a number of ladies assembled in response to invitations sent by Miss McLaughlin, who felt that an organized effort among those experimenting in under- and over-the-glaze painting would be beneficial in its results both to individuals and to the public at large. At this meeting the Cincinnati Pottery Club was organized. Miss McLaughlin was elected President; Miss Newton, Secretary; and Miss Holabird, Treasurer. The club was at first limited to twelve members besides the three officers named. The members were Miss E. G. Leonard, Mrs. Wm. Dodd, Mrs. Plimpton, Mrs. Merriam, Mrs. Frank Ellis, Miss Laura A. Fry, Miss Agnes Pitman, Miss Clara Fletcher, and Mrs. George Dominick.

THE CINCINNATI POTTERY CLUB

NAME	MEMBERSHIP RECORD										
	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890
Miss Fannie S. Banks		√	√	√	√	√	√	√	√	√	√
Miss Boyé											√
Mrs. S. B. Camacho									√	√	√
Miss Florence Carlisle (Mrs. James R. Murdoch)	√	√	√	√	√	√	√	√	√	√	√
Miss Louise Devereux											√
Mrs. William Dodd	√										
Mrs. George Dominick	√	√	√	√	√	√	√	√	√	√	√
Miss Frances G. Eaton						√	√	√			
Mrs. Frederick Eckstein, Jr.							√	√			
Mrs. Rhodes Ellis	√										
Mrs. Walter H. Field	√	√	√	√	√	√	√	√	√	√	√
Miss Clara B. Fletcher	√	√	√	√	√	√					
Miss Laura A. Fry	√	√	√	√	√	√	√	√	√	√	√
Miss A. H. Hinkle		√	√	√	√	√	√	√	√	√	√
Miss Alice B. Holabird	√	√	√	√	√	√	√	√	√	√	√
Mrs. Charles A. Kebler	√	√	√	√	√	√	√				
Mrs. M. V. Keenan	√		√	√	√						
Mrs. E. G. Leonard	√	√	√	√	√	√	√	√	√	√	√
Mrs. Louis C. Leonard								√	√		√
Mrs. A. H. Lewis								√	√	√	√
Mrs. Caroline A. Lord						√	√				
Mrs. A. H. McGuffey		√	√	√	√	√	√	√	√	√	√
Miss M. Louise McLaughlin	√	√	√	√	√	√	√	√	√	√	√
Mrs. A. B. Merriam	√										
Mrs. J. H. Mulligan					√						
Miss Clara C. Newton	√	√	√	√	√	√	√	√	√	√	√
Miss Elizabeth Nourse	√	√	√	√	√	√	√	√	√	√	√
Miss Helen W. Peachey (Mrs. Corwine)				√	√	√	√	√	√	√	√
Miss Agnes A. Pitman	√	√	√								
Mrs. Plimpton	√										
Mrs. Estes G. Rathbone						√	√	√	√	√	√
Mrs. Julia Hall Rice		√	√	√	√	√	√	√	√	√	√
Mrs. S. S. Sykes								√	√	√	√
Mrs. H. C. Yergason								√	√	√	√

In the record of the first meeting I find the following paragraph: "The purpose of the Club shall be the development of the art interests of Cincinnati in the direction of under-the-glaze work in pottery, carving in clays, and through such other methods as may suggest themselves as practicable." After the lapse of years since I last read these minutes, I feel in looking at them now as if the promise had been nobly kept, for I claim now, as I have always claimed, that the impetus given to this work by the Pottery Club has had an incalculable and far-reaching influence.

The early work of the Club was carried on in a room rented from the Woman's Art Museum Association. This Society having opened decorative art rooms in a building which stood on the site now occupied by the Methodist Book Concern, the expenses of the rent, etc., were borne in equal proportions by the members of the Club.

In the early fall of 1879, it became evident to the members of the Club that good work could be successfully accomplished only at a Pottery. A room was rented from Mr. Dallas; access to these quarters was only to be had through the yard of the Pottery in which stood some of the kilns. The room was on the second floor and was very primitive with its whitewashed brick walls. Wooden benches and chairs represented the capital invested in furniture, and in this room was accomplished the work exhibited at the first Pottery Club reception, held April 1, 1880. The unique invitations, etched by Miss McLaughlin, strictly limited to five hundred, were eagerly sought for. The day was ideal. You will see by the photographs I have with me that the brick walls were hung with fine rugs, and great masses of fruit blossoms, dogwood, and palms made the room a floral bower. The room below ours was set out in a brave array of Dallas ware. Some kilns were lit, some were being drawn. Up and down the steep wooden stairs the art lovers and fashion of the city surged from twelve to five o'clock.

Hamilton Roads had never seen such a sight.

When last words of congratulations had been spoken by our departing guests, Mr. Dallas, triumphant and exhausted, dashed into the room to tell us that "carriages had been standing all afternoon up and down both sides of the street and clear around the corner." These carriages were to him the outward and visible sign of whatever inward grace the Club possessed. Annual receptions were given up to the year 1890, but nothing was ever repeated of so unique a nature.

The Ali Baba Vase

The photographs show the famous Ali Baba, the largest vase, so far as known, ever cast in this country. This was the manner of its christening. As I came into the work room one morning I saw Miss McLaughlin mounted on a chair before a huge vase with a proportionately huge brush with which she was laying on a background, handling the color very much after the manner in which a scene painter works. Being at that time of an age when familiarity with fairy tales was not in the very remote past, the tale of the forty thieves and the jars in which they concealed themselves flashed through my mind and I exclaimed, "You are painting a regular Ali Baba vase." Ali Baba the vase became and as Ali Baba will go down in history.

The blue and white vase, which I have carried in from my studio, was also exhibited in 1880. It was my masterpiece then, and I am not sure that it does not still hold that position. The blue remained clear cut without a line flowing, rather remarkable in so large a piece. A cut of it may be found with illustrations of Miss McLaughlin's, Miss Fry's, and the work of other artists in the chapter on Cincinnati in Mr. Edwin A. Barber's recently published history of the Pottery and Porcelain of the United States.

In the fall of 1880, Mrs. Storer founded the Rookwood Pottery, and from that time on the Pottery Club distinctly suffered. The workmen who had learned how to glaze and handle work were all engaged to go to the new Pottery. True, for three or four years the doors of Rookwood were open to us, but things were never quite the same. The tender grace of earlier days never came back. The time came when the managers of the Pottery felt, in justice to its own interests, that Rookwood must close its doors to outside workers, including the Pottery Club, a Club that had in individual experiments spent sums that aggregated hundreds of dollars. The fortunes of war were ours; we accepted them with what grace we could summon and turned our attention to over-the-glaze painting.

Exhibits have been made by the Pottery Club in this country and in Europe always with success and bringing increased reputation to the Club. During the exhibit at Howell and James in London, Miss Holabird had one of her pieces in carved clay bought by the Prince of Wales. Had she been an English girl, her fortune would have been made.

In the spring of 1890, work was exhibited in Philadelphia under the auspices of the Pennsylvania Museum. Russell Sturgis, the art critic, said in his report: "Cincinnati carries off the honors. The work exhibited comes nearer to supplying the demand for china that is tasteful and fitted for daily use than anything probably in the whole exhibit. . . . . Before leaving the mention of these pieces it must be stated that there is nothing amateurish about the work. I do not know these ladies, but their influence must be great in the community in which they live."

Directly following the Philadelphia exhibit, the last reception of the Pottery Club was given. The work was very fine but the percentage of sales was so small that it was considered inadvisable to continue to produce expensive work for which there seemed so little demand, and in a meeting shortly after the reception it was decided to discontinue the Club.

In 1891, when the Columbian Exposition work was begun, Mrs. Potter Palmer in personal letters addressed both to the President and Secretary of the Club, insisted upon the importance of the Cincinnati Pottery Club, and in every possible way urged the necessity of an exhibit. Later, when the National Ceramic Association was talked

Anniversary Exhibits of Cincinnati Pottery Club Artware
At right may be seen the famous Ali Baba jar made by Miss McLaughlin

Anniversary Exhibits of Cincinnati Pottery Club Artware

of as possible, a committee from Chicago came to Cincinnati to secure the cooperation of the Pottery Club and its officers in view of the influence that would thereby be exerted. After much consultation, Miss McLaughlin called the Club together once more. We organized, never I hope, to disband again. The exhibit of the Club's work in Chicago was finally made in the Cincinnati room. It was my privilege to have an active working interest in the room, which threw me in contact with various foreigners interested in ceramics. They always made it a point to find the Pottery Club Exhibit. It was frequently written up in foreign journals, and always favorably.

Not more than six weeks ago a Frenchman traveling in this country came to my studio to inquire about the work. It seems that his curiosity had been excited by an article written by Madame Benson, who was sent to the Exposition as a journalist for the *Revue des Deux Mondes*. She criticized everything in the Woman's Building sweepingly, the one notable exception being the Pottery Club Exhibit, of which she said, "One will hear great things of it in the immediate future. The exhibit would attract attention any day if made on the most noted boulevards of Paris."

Mr. Chas. Binns of the Royal Worcester Pottery said to me, "I do not think it better technically than other American work; but there is about it a spirit of originality that sets it apart; one does not in looking at it think it is a copy of Doulton, Worcester, or Royal Berlin, but one realizes thought in the decoration, although there may be a mistake in the art principle applied."

At the Ceramic Congress in September, 1893, at the Chicago Art Institute, the Club and the fact that from it had sprung similar organizations all over the country was referred to again and again. The Pottery Club of Cincinnati was undoubtedly considered the nucleus from which other work has sprung. Its position was a preeminent and a proud one.

I am often asked, "What is the Pottery Club doing?" I admit that it seems to sleep, but when called upon for active work, has it ever failed to respond?

Miss McLaughlin is now engaged in experimenting with

Anniversary Exhibits of Cincinnati Pottery Club Artware

Tenth Anniversary Celebration of Cincinnati Pottery Club

(1) Mrs. A. H. McGuffey, (2) Mrs. Walter Field, (3) Miss Clara Chipman Newton, (4) Mrs. A. H. Lewis, (5) Mrs. H. C. Yergason, (6) Mrs. E. G. Rathbone, (7) Mrs. A. H. Hinkle, (8) Miss Mary Louise McLaughlin, (9) Mrs. George Dominick, (10) Miss Alice Holabird, (11) Mrs. J. R. Murdoch, (12) Miss Julia Rice, (13) Miss H. W. Peachey, (14) Miss F. S. Banks, (15) Mrs. G. S. Sykes; (hidden) Miss Laura Fry.

a new discovery in pottery painting. The decoration is obtained with an entirely original method. I regret that an exhibit of the work cannot be made today, but she feels that it is yet in too crude a stage to justify a public exhibition.

Let us feel that the Pottery Club is now, as always, a factor in the art life of Cincinnati. Believe me that nothing else of the kind can ever in the minds of the public, at home or abroad, replace in historic interest the position won and maintained by the Cincinnati Pottery Club.

Tenth Anniversary of Pottery Club

From the *Cincinnati Enquirer*, April, 1889; clipping headed "Pretty Artists Gather About the Round-Table in Celebration of the Tenth Pottery Club Anniversary."

"The members of the Cincinnati Pottery Club yesterday celebrated the tenth anniversary of the formation of the club by a *dejeuner à la fourchette* at the Queen City Club..... Eli Landy came at the close of the feast and by the flashlight took the group of merry artists around the tables..... The Cincinnati Pottery Club numbers twenty members. Since its organization ten years ago there has been but one called away to the other shore, Mrs. Charles Kebler. Her mother, Mrs. Leonard, and her sister, Mrs. Lewis, are now living in Chicago, but Mrs. Lewis came to this city expressly for the anniversary meeting. Of the others who were not present, Miss Elizabeth Nourse is in Paris, Mrs. Camacho is in the Windward Islands, and Mrs. Louis Leonard is in Denver.

THE CINCINNATI POTTERY CLUB
ANNUAL RECEPTIONS

Place Held	Year	
Frederick Dallas Pottery (Hamilton Road)	May 5, 1880	(First Annual)
The Literary Club (24 W. Fourth St.). Exhibit at Dallas Pottery	April 29, 1881	(Second ")
The Literary Club. Exhibit at Dallas Pottery	May 12, 1882	(Third ")
The Literary Club. Exhibit at Dallas Pottery	May 1, 1883	(Fourth ")
The Railway Club (The Ortiz)	May 16, 1884	(Fifth ")
The Ohio Club (The Ortiz)	May 29, 1885	(Sixth ")
Lincoln Club (Race and Eighth Sts.)	Dec. 17, 1886	(Seventh ")
Lincoln Club	Dec. 21, 1887	(Eighth ")
Lincoln Club	Dec. 6, 1888	(Ninth ")
Lincoln Club	March 27, 1890	(Tenth ")

PORCELAIN LEAGUE OF CINCINNATI

(From a newspaper clipping, dated January 10, 1914)

Twentieth Anniversary

In commemoration of their twentieth anniversary, the Porcelain League will add a very beautiful treasure to the list of gifts it has already made to the Art Museum, in the shape of a choice bit of the work of Miss M. Louise McLaughlin. About four years ago the League gave to the Museum a valuable collection of enamels on copper, done by Miss Riis in Berlin many years ago, and at the time of the Handicraft Exhibition here a little later it gave a notable enamel plate by a Chicago woman of note. It is keenly fitting that the gift now should be one of Miss McLaughlin's lovely pieces of pottery, for she is one of the very notable members of the old Pottery Club, whose ideals and traditions the Porcelain League was organized to maintain.

Saturday at Mrs. E. E. Kellogg's charming home on Eastern Avenue, the Porcelain League celebrated its twentieth anniversary in an afternoon that was artistic as befitted so notable an occasion.

The Leaguers first met about a long table, bright with pink carnations, and Miss Newton gave a history of the League and of the old Pottery Club from which it grew, her account bringing out the fact that the League is probably the oldest woman's club extant. The paper recalled the exhibit of the old Pottery Club in London, in the days when any woman's work outside of the home was a novelty and when the bits of pottery and china of the Club were admired by no less a personage than the Prince of Wales. Mrs. Corwine outlined a glowing prophecy for the Club and many responses to toasts made lengthy the list of good wishes.

Then came a clever little play that Miss Kellogg had arranged. Its first part was in three tableaux, than which there has been no more artistic thing in society theatricals in a long time. The interior for the tableaux was a faithful

representation of the old Dallas Pottery, meeting place and scene of the endeavors of the old Pottery Club. There was even a representation of Miss McLaughlin's famous "Ali Baba" vase, dating back in the '70's. Posing in this old Pottery of by-gone days, in wonderful old-time gowns were Miss Newton, who wore a sky-blue gown that a belle of President Hayes' administration wore at Presidential functions, the gown having been unearthed from the treasures of Mrs. James Riley Murdoch for the occasion. It was interesting to note its pleated train, its skirt with a "pocket," and its clever basque with pleated tails. The silk was of beautiful texture, and thirty years had left scarcely a mark on the gown, which was as fresh as if just out of tissue paper, so good is its material and so careful its wearer of other days with her party frock. Miss Alice Holabird was in a lavender velvet of years ago. So cleverly had she arranged her hair with the old-fashioned curls and so becoming was the gown with its bustle and its tight sleeves and narrow draped shirt that a thrill of admiration ran over the little audience who viewed her as she was when the gown was new. Miss McLaughlin completed the group of three who posed.

row of funny heads and shoulders rising above the "footlights," in between the palms to either side of the "stage," and which was one of the amusing features of the afternoon.

Mrs. Walter Field was the first president of the Porcelain League, which was organized on January 10, 1894, in the studio of Miss Laura Fry, who is a noted carver. She is a daughter of William Fry and a granddaughter of Henry Fry, whose names are indelibly linked with the art of carving. Miss Fry is now connected with Purdue University. She and her sister, Mrs. Lillie Fry Fisher, still retain their membership and interest in the Porcelain league. Its other members include Miss Abbie Gray, Mrs. Edward C. Mills, Mrs. Samuel Corwine, Miss Elizabeth Kellogg, Mrs. George Dominick, Miss Alice Holabird, Mrs. Ida Holterhoff Holloway, Mrs. Russell Chapman, Miss Clemmer, Miss Clara Chipman Newton, Mrs. Robert M. Burton, Mrs. H. C. Yergason, Mrs. William Stanage, Sr., Mrs. Luke Smith, Mrs. Edwin Kellogg, Miss Anna Riis, Miss Anna Boyé, and several others. The late Mrs. Herman Hoppe was a member. One of the interesting exhibits at the luncheon was a photograph of members of the old Pottery

Members of the Porcelain League Present at Twentieth Anniversary, January 10, 1914

(1) Mrs. G. Clarence Holloway (Ida Holterhoff) (always known, however, as Mrs. Ida H. Holloway); (2) Miss Carrie M. Clemmer; (3) Miss Clara Chipman Newton; (4) Miss Alice B. Holabird; (5) Mrs. Samuel L. Corwine (Helen Peachey); (6) Mrs. Luke W. Smith (Norma Hall); (7) Miss Anna C. Boyé; (8) Mrs. Robert M. Burton (Mary Tylor); (9) Mrs. Edwin E. Kellogg (Josephine Greenwald); (10) Miss Abbie Gray; (11) Mrs. Henry C. Yergason (Katherine Bartlett); (12) Miss Anna Riis; (13) Mrs. Edward C. Mills (Cora Brown); (14) Mrs. George De Forest Dominick (Mary Taylor); and (15) Mrs. T. Russell Chapman (Mary Weighell).

Miss Kellogg called her little endeavor, "The Spirit of the League," and the tableaux represented the "past." Then came the "present." The interesting curtain, painted by Mr. Martin Rettig and Mr. John Reilly, rolled up to reveal a cosy sitting room and Mrs. Smith and Mrs. Kellogg working and talking of the "anniversary." Mrs. Corwine joined them, and the reference to past joys, meetings at Mrs. H. H. Eckstein's farm, in Mrs. Field's lovely garden, and in Mrs. Smith's garden, and other joys, made every bit of their conversation interesting to the audience. Mrs. Mills and Mrs. Holloway came in with news of the "Crafters."

The last scene was the "future," and it was a far future—showing "heaven," with Mrs. Robert Burton just entering to join the League angels, Miss Riis, Mrs. Dominick, Mrs. Yergason, Miss Gray, and several others, whose faces fitted into a drop curtain painted by Mrs. Holloway and Mrs. Burton. This ended the afternoon, of which a description would be incomplete without mention of the "orchestra," a Club taken at an anniversary meeting in the Queen City Club.

This Pottery Club was not only the first of its kind in America but one of the first of women's clubs; indeed, it may have been the pioneer of all women's clubs. Organized shortly after the Centennial Exposition, its members were keenly interested in art, and especially in the underglaze which one of their leading spirits, Miss M. Louise McLaughlin, perfected after many experiments.

The members worked much at the old Dallas Pottery, where Mr. Bailey, whom later Mrs. Bellamy Storer made head potter at Rookwood, was much interested in them.

Many years ago they gave an exhibition in London, and the English papers gave much space to this "women's work," which was somewhat of a revolutionary nature in those days. The Prince of Wales himself bought some of the ware and "certificates of merit" are still prized possessions of members of the pioneer organization or of their descendants.

The history of the Pottery Club and its successor, the Porcelain League, is full of sentiment. Many little customs bound the membership together. One of these was an exchange twice a year of handpainted cups, the exchange so arranged that, in time, each of the members should have some of the work of all the others. Some of the members have an array of these cups and such a collection is indeed a treasure. In remembrance of this old custom, the exchange of cups takes place at the anniversary of the Porcelain League. The cups for this year were imported last June, and their workmanship is especially beautiful.

IDENTIFICATION OF CINCINNATI POTTERY CLUB AND PORCELAIN LEAGUE GIFTS TO THE AMERICAN CERAMIC SOCIETY

1. Overglaze decorated china, 1893 Columbia Exposition, blue ribbon; painted and presented by Alice B. Holabird.
2. Overglaze decorated china; painted in 1893 and presented by M. Louise McLaughlin.
3. Parian, designer not known; presented by Florence Murdoch.
4. Underglaze painting, 1885; done and presented by Laura A. Fry.
5. Underglaze slip, painted 1881 by Florence Carlisle; presented by Florence Murdoch.
6. Underglaze slip painted 1881 by Clara Chipman Newton; presented by Florence Murdoch.
7. Underglaze stain, cutout design, vapor glaze; done and presented by Laura A. Fry.
8. Overglaze painted for Centennial Tea Party 1875; presented by Florence Murdoch.
9. Plate painted by M. Louise McLaughlin, Tenth Anniversary, Pottery Club, 1889; presented by Laura A. Fry.
10. Overglaze painted by Mary Weighell Chapman, 1901; presented by Alice B. Holabird.
11. Underglaze slip-painted Lenox; done and presented by Laura A. Fry.
12. Plate painted by Julia H. Rice for Tenth Anniversary, Pottery Club, 1889; presented by Florence Murdoch.
13. Overglaze, 1885 by Florence Carlisle Murdoch; presented by Florence Murdoch.
14. Overglaze painted by crayon 1884; done and presented by Laura A. Fry.

15–16–17–18–19–20–21. Losanti one-fire porcelain; made and presented by M. Louise McLaughlin, 1898–1902 (see *The Bulletin*, **17** [5] 221 (1938)); No. 21 is copper red.

22–23–25–26. Underglaze slip painting by M. Louise McLaughlin.

24. Terra-cotta panel; made and presented by Laura A. Fry.

27–33. Underglaze slip painted 1878–1880; made and presented by M. Louise McLaughlin.

Gifts to The American Ceramic Society Exhibit

Your Cooperation Through
THE AMERICAN CERAMIC SOCIETY

To live and advance one must mingle and seek cooperation with men of similar vocations and avocations.
There must be an organized, orderly, and democratic program of cooperation.
Such an agency must have working tools, such as meetings and publications.
Your profits will increase as the strength of your American Ceramic Society increases through Meeting programs and Membership support.

CELO KYANITE
UNIFORM QUALITY DEPENDABLE SUPPLY
FOR INFORMATION AND SAMPLES WRITE TO
CELO MINES, INCORPORATED
BURNSVILLE, NORTH CAROLINA

ACTIVITIES OF THE SOCIETY

GLASS DIVISION AUTUMN MEETING

The Glass Division held its Autumn Meeting at the Hotel Hershey, Hershey, Pa., September 6 and 7. The following papers were presented at the technical sessions:

(1) "Effect of Surface Tension on Rate at Which One Glass Will Diffuse in Another Glass" by W. B. SILVERMAN, Owens-Illinois Glass Co., Toledo, Ohio.

(2) "Homogeneity and Heterogeneity of Commercial Glass" by F. W. PRESTON and J. C. TURNBULL, Preston Laboratories, Butler, Pa.

(3) "Notes on Flaking of Glass Containers" by W. R. LESTER, Maryland Glass Corp., Baltimore, Md.

(4) "Some Observations on Chemical Durability of Glass" by A. K. LYLE and D. E. SHARP, Hartford-Empire Co., Hartford, Conn.

(5) "Upward Drilling" by F. W. PRESTON and J. C. TURNBULL.

(6) "A.S.T.M. Report on Chemical Analysis of Glass" by G. E. F. LUNDELL, National Bureau of Standards, Washington, D. C.

(7) "Report of Committee C-14 A.S.T.M. Activities" by LOUIS NAVIAS, General Electric Co., Schenectady, N. Y.

REFRACTORIES DIVISION AUTUMN MEETING

The Refractories Division Autumn Meeting was held at the Summit Hotel, Uniontown, Fayette County, Pa. September 6 and 7.

The following papers on "Blast-Furnace Refractories" were presented at the technical session on Friday morning, September 6:

(1) "Refractory Service Conditions in the Blast Furnace" by H. M. KRANER, Bethlehem Steel Corp., Bethlehem, Pa.

(2) "Some Reminiscences on Brick Used for Blast Furnaces and Hot Blast Stoves" by JAMES G. WEST, JR., Pittsburgh, Pa.

(3) "Expansion and Contraction of Refractories in Blast Furnaces" by A. M. MORTON, Pittsburgh Steel Co., Monessen, Pa.

(4) "Refractory Requirements for Electric Smelting of Iron Ores" by CHARLES HART, Delaware River Steel Corp., Chester, Pa.

WHITE WARES AND MATERIALS AND EQUIPMENT DIVISIONS AUTUMN MEETING

The White Wares and Materials and Equipment Divisions Autumn Meeting was held at the Summit Hotel, Uniontown, Fayette County, Pa., September 13 and 14.

The subject of the Friday technical session was "Processing and Forming," and the following papers were presented:

(1) "Application of Automatic Power Pressing" by GEORGE ADERHOLD, Saxonburg Potteries, Saxonburg, Pa.

(2) "Centrifugal Slip Casting" by C. R. AUSTIN and G. H. DUNCOMBE, JR., Battelle Memorial Inst., Columbus, Ohio.

(3) "Application of Air Hardening Tool Steel for Jigger Tools" by W. H. EMERSON, Homer Laughlin China Co., Newell, W. Va.

Papers presented on Saturday morning were as follows:

(1) "Application of Photography in Ceramics" by W. D. FORD, Ford Ceramic Arts, Inc., Columbus, Ohio.

(2) "Use of a High Sericite Pyrophyllite in Vitreous Bodies" by E. W. EMRICH, R. T. Vanderbilt Co., Inc., New York, N. Y.

(3) "Test of Casting Slips" by J. H. KOENIG, Hall China Co., East Liverpool, Ohio.

Following the paper by Dr. Koenig, there was a discussion on "Methods of Test and Control of Raw Materials" led by J. R. BEAM, Universal Sanitary Mfg. Co., New Castle, Pa.; A. J. BLUME, Square D Co., Peru, Ind.; and C. J. KOENIG, Engineering Experiment Station, Ohio State Univ., Columbus, Ohio.

POTTERY MAKING COURSE AT BLUE RIDGE

A complete course of instruction in the art of pottery making proved to be one of the most popular features of the Sixth Annual Art Conference held from July 29 to August 4 at Blue Ridge, N. C.

The course was taught for the second consecutive summer by Kenneth E. Smith, head of the Ceramic Art Department at Sophie Newcomb Memorial College, New Orleans, La. He was assisted by ceramists from many parts of the country.

Kenneth Smith Tooling Thrown Vase

Group Picture of Ceramic Art Class

A well-rounded program included lectures, demonstrations, and visits to the leading pottery and handicraft studios near Asheville, N. C., and exhibits of pottery and ceramic sculpture made by potters in North Carolina and other states.

A special workshop was constructed which was equipped with a hog kiln, kick wheels, bench whirlers, an electric kiln, and supplies of various clays.

Prominent ceramists taking part in the Art Conference program were Ross C. Purdy, General Secretary of The American Ceramic Society; Miss Anna W. Olmsted, founder of the National Ceramic Exhibition, Syracuse, N. Y.; and Edwin and Mary Schirer of Glade Spring, Va.

Mary Schirer Throwing on Kick Wheel

Edward Schirer Modeling Terra Cotta by Coil Method

CHICAGO SECTION MEETING, SEPTEMBER 20, ON REFRACTORIES

A symposium on acid, basic, and neutral refractories will be held under the auspices of the Chicago Section, The American Ceramic Society, and of the Department of Ceramic Engineering, University of Illinois, Friday evening, September 20, 1940, at 7:30 P.M. in the auditorium of the Chicago Lighting Institute, 36th floor, Civic Opera Building, Wacker Drive and Madison streets, Chicago, Ill.

The following papers will be presented:

(1) "Temperature vs. Refractories" by Robert B. Sosman, Research Lab., U. S. Steel Corp., Kearny, N. J.

(2) "Service Application of Acid Refractories" by W. F. Rochow, Harbison-Walker Refractories Co., Pittsburgh, Pa.

(3) "Service Applications of Basic Refractories" by R. P. Heuer, General Refractories Co., Philadelphia, Pa.

Members of various engineering groups in the Chicago area, as well as operators of melting and other high-temperature equipment, are being invited to attend.

—REXFORD NEWCOMB, JR., *Secretary*

VACATION, VIGOR, VITALITY, VIM, VICTORY

Behold the Increase Resulting

Two thousand paid Personal Members by December 20? Certainly.

And how many more Corporation Members?

This is up to you.

Paid Membership Record

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
December 22, 1937	1713	220	12	523	220	2688
December 19, 1938	1815	222	26	589	220	2872
December 19, 1939	1876	237	27	642	220	3002
January 22, 1940	1930	244	23	656	220	3073
February 20, 1940	1972	243	30	669	220	3134
April 17, 1940	1724	241	30	522	220	2737
May 21, 1940	1801	247	27	552	220	2847
June 19, 1940	1839	251	28	556	220	2894
July 18, 1940	1870	254	32	561	220	2937
August 19, 1940	1885	254	31	565	220	2955
August 19, 1939	1786	233	37	615	220	2891
1940 gain	99	21				64

ROSTER CHANGES DURING JULY*

BOYD, WALTER B., c/o Mrs. George A. Harris, 241 Young Ave., Henderson, N. C. (Clarkesville, Ga.)

EBRIGHT, H. E., 17895 Lake Rd., Lakewood, Ohio (Cicero, Ill.)

FICHTER, GEORGE W., Route 1, Rossville, Ga. (Chattanooga, Tenn.)

LEAVY, JOHN C., Colonial Park, Dauphin County, Pa. (Glenside, Pa.)

MILLER, RUSSEL A., 402 DeKalb St., Bridgeport, Pa. (Norristown, Pa.)

MITCHELL, LANE, Ceramic Department, Pennsylvania State College, State College, Pa. (Atlanta, Ga.)

PENCE, F. K., Division of Industrial Chemistry, University of Texas, Austin, Texas (San Antonio, Texas)

TEETOR, PAUL, 253 Altamont Place, Somerville, N. J. (Poultney, Vt.)

WALL, GERTRUDE R., 5506 Telegraph Ave., Oakland, Calif. (Wailuku, Maui, Hawaii)

WILLIAMS, ARTHUR E., 1218 Fifth St., Moundsville, W. Va. (State College, Pa.)

WILSON, EARL O., Yenching University, 150 Fifth Ave., New York, N. Y. (Peiping, China)

WORK, LINCOLN T., Metal & Thermit Corp., Carteret, N. J. (New York, N. Y.)

ZEILLER, OSCAR F., 42–38 204th St., Bayside, L. I., N. Y. (New York, N. Y.)

ROSTER CHANGES DURING AUGUST*

CLEEVES, GEORGE A., 231 Park Drive, S-33, Boston, Mass. (Cambridge, Mass.)

GERBER, MAX, Kokomo Sanitary Pottery Corp., 155 N. Clark St., Room 818, Chicago, Ill. (Kokomo, Ind.)

KOLSTAD, JOHN H., Y.M.C.A., Box 105, Tiffin, Ohio (Rochester, N. Y.)

MILLER, JAMES L., Johns-Manville Corp., Research Labs., Manville, N. J. (Somerville, N. J.)

MORGAN, WILLIAM R., 6 High St., Westboro, Mass. (New Brunswick, N. J.)

REIF, RICHARD E., 1001 Wooster Ave., Dover, Ohio (Homewood, Ill.)

RIGDON, HOWARD K., 169 Aurora St., Hudson, Ohio (Painesville, Ohio)

SCAVENS, M. J., Harbison-Walker Refractories Co., Fairfield, Ala. (Augusta, Ga.)

SHONFELD, T. H., 155 E Street, S.E., Washington, D. C. (Lawrenceburg, Ind.)

STEVENS, JOE, Emsco Refractories Co., South Gate, Calif. (Vernon, Calif.)

STOLTE, NORMAN H., 810 Wayne Place, Fremont, Ohio (Cleveland, Ohio)

TURNER, CECIL H., 884 Chester Road, Charleston, W. Va. (Cincinnati, Ohio)

* Address in parentheses is former address.

NEW MEMBERS FOR AUGUST

Personal

BOYD, JOHN B., Box 1882, Reno, Nev.; president, Reno Tile & Marble Co.

FISHER, HELEN, 36 N. Walcott St., Salt Lake City, Utah.

GAUNDER, WILBUR F., 805 N. Gay St., Mt. Vernon, Ohio; ceramic engineer, Pittsburgh Plate Glass Co.

*HANSARD, W. C., Atlanta Industrial Labs., 747 Cherry St., N.W., Atlanta, Ga.

MEYER, GEORGE W., Glenshaw Glass Co., Inc., Glenshaw, Pa.; secretary.

PIEPER, ARTHUR O., Box 892, Rochester, N. Y.; treasurer, Clark Quality Products, Inc.

RIGTERINK, MERLE D., Bell Telephone Labs., 463 West St., New York, N. Y.; research engineer.

THOMAS, JAMES A., Iroquois China Co., Syracuse, N. Y.; ceramist.

YOUNT, RICHARD V., Box 435, Oakmont, Pa.; Gulf Research & Development Co.

Student

North Carolina State College: RICHARD P. MCCABE.

* Indicates former member of The Society rejoining.

MEMBERSHIP WORKERS' RECORD FOR JULY AND AUGUST

Corporation

Office	1

Personal

C. B. Delgado	1	Lane Mitchell	1
Donald Hagar	21	D. E. Sharp	1
C. M. Harder	1	K. Takahashi	1
J. C. Hostetter	1	Office	3

Student

J. L. Carruthers	1	W. W. Kriegel	1
		Grand Total	**33**

RULES OF THE FELLOWSHIP REVISED

Article IV. Nominations and Elections

(1) The Dean shall appoint two (2) Nominating Committees, each to be composed of three (3) members. Each Committee shall select a candidate for Dean, a candidate for Associate Dean, and a candidate for Secretary-Treasurer by majority vote, and report the names, together with the acceptance of each candidate so selected, to the Dean of Fellows at least ninety (90) days prior to the Annual Meeting of THE SOCIETY.

(2) The Dean shall transmit the nominations to the General Secretary of THE SOCIETY, who shall submit ballots by mail to each Fellow at least sixty (60) days prior to the Annual Meeting of THE SOCIETY. The ballots shall bear the names of the nominees in alphabetical order and the closing date of the voting.

The ballots shall be returned to the Dean of Fellows in a plain envelope marked only with the words "Fellow Ballot." This envelope shall be enclosed in another envelope for mailing, upon the back of which the voter shall endorse his name. Only those ballots so returned thirty (30) days before the opening date of the Annual Meeting shall be counted.

The Dean of Fellows shall have the ballots counted as soon as practicable after the close of the voting and shall transmit the results of the election to the General Secretary of THE SOCIETY.

INSTITUTE OF CERAMIC ENGINEERS

Executive Committee

President: H. G. WOLFRAM, Porcelain Enamel & Mfg. Co., Baltimore, Md.

Vice-President: E. H. FRITZ, Westinghouse Electric & Mfg. Co., Derry, Pa.

Secretary: H. M. KRANER, Bethlehem Steel Corp., Bethlehem, Pa.

Trustee: R. E. BIRCH, Harbison-Walker Refractories Co., Pittsburgh, Pa.

Past-President: J. L. CARRUTHERS, Ohio State Univ., Columbus, Ohio

Committee on Rules

Chairman: M. F. BEECHER, Norton Co., Worcester, Mass.

W. C. RUECKEL, Koppers Co., Pittsburgh, Pa.

W. K. MCAFEE, Universal Sanitary Mfg. Co., New Castle, Pa.

Committee on Membership and Examinations

Chairman: A. S. WATTS (3 years), Dept. of Ceramic Engineering, Ohio State Univ., Columbus, Ohio

C. F. GEIGER (5 years), Carborundum Co., Perth Amboy, N. J.

ROBERT TWELLS (1 year), Electric Auto-Lite Co., Spark Plug Div., Fostoria, Ohio

H. N. BAUMANN, JR. (3 years), Carborundum Co., Niagara Falls, N. Y.

T. A. KLINEFELTER (4 years), National Bureau of Standards, Washington, D. C.

Committee on Ceramic Engineering Education

Chairman: E. H. FRITZ (3 years), Westinghouse Electric & Mfg. Co., Derry, Pa.

R. M. CAMPBELL (2 years), N. Y. State College of Ceramics, Alfred, N. Y.

H. T. COSS (1 year), Johns-Manville Corp., Manville, N. J.

R. K. HURSH (4 years), Dept. of Ceramic Engineering, Univ. of Illinois, Urbana, Ill.

J. R. BEAM (5 years), Universal Sanitary Mfg. Co., New Castle, Pa.

Committee on State Boards of Engineering Examiners

Chairman: A. F. GREAVES-WALKER, Dept. of Ceramic Engineering, Univ. of North Carolina, Raleigh, N. C.

Assistant Secretaries: R. M. KING, Dept. of Ceramic Engineering, Ohio State Univ., Columbus, Ohio; H. B. DUBOIS, Consolidated Feldspar Corp., Trenton, N. J.; T. N. MCVAY, Dept. of Chemistry, Univ. of Alabama, University, Ala.; W. D. BOZMAN, Denver Pressed Brick Co., Loveland, Colo.; and C. H. ZWERMANN, Univ. of Washington, Seattle, Wash.

Committee on Professional Status and Development

Chairman: J. W. WHITTEMORE, Dept. of Ceramic Engineering, Virginia Polytechnic Institute, Blacksburg, Va.

R. S. BRADLEY, A. P. Green Fire Brick Co., Mexico, Mo.

A. T. MALM, Norton Co., Worcester, Mass.

Nominating Committees

Committee A: HEWITT WILSON, Electrotechnical Lab., U. S. Bureau of Mines, Norris, Tenn.

Committee B: L. C. HEWITT, Laclede-Christy Clay Products Co., St. Louis, Mo.

Executive Nominating Committee

Chairman: T. A. KLINEFELTER, National Bureau of Standards, Washington, D. C.

S. F. WALTON, Exolon Co., Blasdell, N. Y.

K. E. BUCK, Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.

J. W. HEPPLEWHITE, 241 Pennsylvania Ave., East Liverpool, Ohio

C. R. AMBERG, Box 122, Alfred, N. Y.

GROW BY GETTING MORE NEW MEMBERS TO JOIN THE SOCIETY

NECROLOGY

MAURICE A. SMITH

Maurice Alexander Smith, president of the McKee Glass Company, Jeannette, Pa., died on July 22, 1940, at the age of fifty-one.

Mr. Smith was born in Fostoria, Ohio, and was a graduate of Mercersburg Academy and Cornell University. He became affiliated with the McKee Glass Company in 1911 and assumed the presidency in 1924 after serving successively as foreman, salesman, vice-president, and general manager.

Mr. Smith was the author of numerous papers on glassware manufacture. He was a member of the Board of Directors of the Westmoreland Motor Freight lines, the McKee Realty Co., the Glass City Bank, the Jeannette Thrift Corp., the Shawnee Mfg. Co., the American Glassware Manufacturers and Associated Glass and Pottery Manufacturers, and the National Association of Manufacturers of Pressed and Blown Glassware.

He was also a member of the Jeannette Chamber of Commerce, the Society of Automotive Engineers, the Elks, and the Greensburg Country Club. Mr. Smith had been a member of The American Ceramic Society since 1918.

He is survived by his widow, five sons, and one daughter.

RUSSELL N. LONG

Russell N. Long, manager of the Charles Taylor Sons Co., Taylor, Ky., died suddenly at the home of his parents in Newark, Ohio, August 9, 1940.

Mr. Long was born in Spring Mills, Pa., in 1894. He attended the Newark public schools and in 1918 was graduated from Ohio State University with the degree of Bachelor of Science in Ceramic Engineering. He received his Professional Degree of Ceramic Engineer from the same University in 1936. He was a member of the Alpha Tau Omega fraternity.

He was employed successively at the U. S. Bureau of Mines, Columbus, Ohio; the Federal Terra Cotta Co., Woodbridge, N. J.; the Red Wing Union Stoneware Co., Red Wing, Minn.; the W. S. George Pottery, Canonsburg, Pa.; and the Charles Taylor Sons Co., Taylor, Ky., plant.

Russell N. Long

Mr. Long resided with his wife and two children in Portsmouth, Ohio, where he had been active in Boy Scout work for many years. He was also a Mason.

He had been a member of The American Ceramic Society since 1919.

NOTES AND NEWS

F. K. PENCE TO HEAD CERAMIC DEPARTMENT AT THE UNIVERSITY OF TEXAS

Forrest K. Pence, former president of The American Ceramic Society, has been appointed to direct the Ceramic Division in the Bureau of Industrial Chemistry of the University of Texas at Austin, Texas. Mr. Pence, formerly of Paducah, Ky., has been president of the Pence Tile Works, Inc., at San Antonio, Texas. His contract with the University of Texas permits his continuance of industrial contacts.

E. P. Schoch, Director of the Bureau of Industrial Chemistry at the University of Texas, writes as follows:

"The Bureau of Industrial Chemistry of the University has started, on July 1, 1940, a Division of Ceramics in charge of a well-known and experienced ceramic engineer, F. K. Pence. It is the primary object of this Division to develop an industry to manufacture fine tableware and other high-grade ceramic products.

"It is believed that Texas is ready for ceramic developments but that such developments will not be made until the State puts to work competent men to ascertain the ceramic materials available and to teach its citizens how to set up and conduct ventures of this sort. In this pioneer work, both technical ability and commercial experience are necessary, and for this reason it is considered to be a matter of good fortune that the Bureau was able to secure Mr. Pence for this work."

ELECTRO REFRACTORIES AND ALLOYS CORPORATION FELLOWSHIP

This Fellowship at the New York State College of Ceramics, which is awarded to junior rather than to senior students, is to be continued after two years of trial has proved its effectiveness and usefulness. The award for 1940–1941 was made to Robert A. Whitwood of Friendship, N. Y. Mr. Whitwood ranks at the top of his class scholastically, is a member of the varsity basketball team, and is president of the Alfred Student Branch of The American Ceramic Society. His thesis in connection with this Fellowship will deal with the technology of refractory specialties of the silicon-carbide type.

Norman Kendall, the holder of this Fellowship for 1939–1940, was graduated magna cum laude and is now employed by the Electro Refractories and Alloys Corporation.

WEST VIRGINIA UNIVERSITY EXTENSION

Newell Ceramic Art and Science School

Three years ago, a number of young men apprentices of the Homer Laughlin China Company approached A. V. Bleininger on the matter of giving them instruction in some of the fundamentals of ceramic science so that they

could have a better understanding of potting and, if possible, to equip themselves for vocational advancement. Out of this approach grew a movement to make instruction available to the men, not only in the basic sciences of chemistry, physics, and mathematics, and later, in a broader sense, in ceramic technology, but also in the art of ceramic design, modeling, and decoration.

As the Homer Laughlin China Company had no classroom facilities, the local Board of Education representatives were asked to make available the facilities of the Wells High School of Newell, W. Va., for this class. This was done with the stipulation that instruction should not be restricted to any individuals but open to the public. As a result of publicity by word of mouth and newspapers, classes were formed which numbered students of various educational backgrounds, ranging from the sixth grade to college graduates. Employees were enrolled not only from potteries and refractories and brick plants but also from neighborhood steel mills. Members of the faculties of high schools as far away as Weirton and Steubenville were also included. Instruction in the sciences was given for three hours one night each week and in the art courses for a total of six hours covering two nights per week. Instructors in the sciences were Walter H. Emerson and Harry Thiemecke, with A. V. Bleininger as councillor. The art instructors were H. Garver Miller, Cyril Tofft, and Arthur Hull, with Frederick H. Rhead as director. All of these men are employees of the Homer Laughlin China Company.

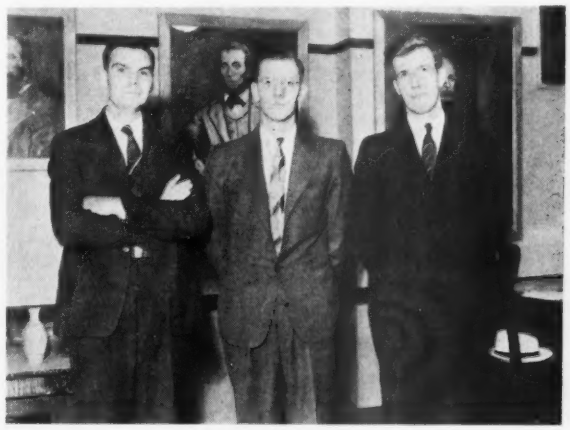
Seated (left to right): Eva Shaw, 2nd in water color; Robert Evans, 2nd in pottery group; Betty Richey, 1st in water color; and Bartley Higgins, 1st in pottery group. Standing: Walter Krebs, 1st in underglaze painting; and James Haworth, 2nd in underglaze painting.

Instructions were carried on under this setup for one year with no connection with the State University. For the purpose of mutual prestige and to compensate the instructors partially for their time and effort, a plan was worked out through the cooperation of G. R. Spindler, Assistant Director of the Mining Extension of West Virginia University and W. A. Koehler, Acting Head of the Department of Chemical Engineering of West Virginia University, whereby the Newell Ceramic School was made part of the Department of Industrial Extension of the University. The compensation for the instructors originally was carried in part by the State and in part by the Federal Government under the Smith-Hughes Act, which has since been modified by legislation. The West Virginia University has recently taken over the complete responsibility of the compensation of instructors.

Owing to other responsibilities, Mr. Emerson was compelled to relinquish his duties as instructor to Maxon H. King of the Edwin M. Knowles China Company.

During the past two years, instruction has been given in water-color painting, sketching, various types of ceramic decorating, modeling, throwing, general chemistry, physics, mathematics, including algebra, plane geometry, logarithms, and trigonometry, structural geology, and clay geology. There have been no repeat courses, each year's work being built on that given the previous year.

It is planned to cover such additional subjects as pyrometry, glaze calculations, fuels, and mineralogy. The standard of work in the sciences ranks between that of high school and college. To supplement theory, examples are drawn from the local industries to show the practical application of scientific basic principles. The science course will continue for an additional year or two with new subject material, after which all of this work will be repeated.



Left to right: Ralph Sanford, 2nd in mathematics; Clifford Balser, 1st in physics; and Hugh Eberhart, 1st in mathematics and 1st in geology.

At the end of the school year, each student who has completed the required work in the various subjects is given a certificate by the West Virginia University. Cash prizes are also awarded by a jury, consisting of local prominent ceramic artists, to the highest ranking students in the science subjects and to those students in the various art courses whose pieces are adjudged best in the solution of a specific design problem. Funds for the prizes are donated by interested local citizens, ceramic manufacturers, and suppliers.

The artware made by the students is put on display at the East Liverpool Carnegie Library auditorium. A number of the better pieces have been displayed at the University of West Virginia during exhibition week, at which time the University buildings are thrown open to the public, and the students demonstrate the work carried on in the various shops and laboratories.

NINTH NATIONAL CERAMIC EXHIBITION

The Ninth National Ceramic Exhibition (annual) will open at the Syracuse Museum of Fine Arts, Syracuse, N. Y., with a preview and reception on Saturday evening, October 12. The exhibition, consisting of pottery and ceramic sculpture, will be open to the public from Sunday, October 13 to November 4.

The deadline for receiving entries is September 30, and the exhibition is an "open show" for which all ceramists of the United States and Canada are eligible.

A "Ceramic Forum," for which speakers will be announced, will be held at the Syracuse Museum on Sunday afternoon, October 13, and will be open to the public.

The Jury will consist of *Chairman*, Reginald H. Poland, Director of the San Diego Gallery of Fine Arts, San Diego, Calif.; Dorothy Liebes, Director, Division of Decorative Arts, Golden Gate International Exposition, San Francisco; Waylande Gregory, Sculptor, New York; Harold Siegrist Nash, Professor of Ceramics, University of Cincinnati, and Chairman, Art Division, The American Ceramic

Society; Kenneth E. Smith, Professor of Ceramics, Newcomb College, New Orleans; *ex officio:* R. Guy Cowan, Art Director, Onondaga Pottery Co., Syracuse, and Trustee and Secretary of Syracuse Museum of Fine Arts; Anna Wetherill Olmsted, Director, Syracuse Museum of Fine Arts.

Prizes have been offered by the American Art Clay Co., Indianapolis; Onondaga Pottery Co., Syracuse; Ferro Enamel Corp., Cleveland; Hanovia Chemical & Manufacturing Co., Newark, N. J.; Harshaw Chemical Co., Cleveland; B. F. Drakenfeld & Co.; and the annual Katherine Q. Payne Memorial Award.

The Jury will also select a limited number of ceramic pieces, including prize-winning works, for the annual circuit sponsored by the Syracuse Museum which follows the large Syracuse showing. Bookings this coming season will include the Memorial Art Gallery, Rochester; Albright Art Gallery, Buffalo; Flint Institute of Art, Flint, Mich.; University of Minnesota, Minneapolis; Cranbrook Museum, Bloomfield Hills, Mich.; and the Baltimore Museum of Art, Baltimore, etc.

The demand for bookings has been so great that the Eighth National Exhibition Tour has been extended through the midsummer months to Sepetember, 1940, instead of ending in June as in former years.

The ceramic group, selected from the Seventh National for inclusion by invitation in the Golden Gate Exposition, has also been on tour ever since the close of the Exposition and will be circuited for *a second season*, opening at the Toledo Museum of Art in September.

BATTELLE MEN RECEIVE ELECTROPLATERS' AWARD

Carl A. Zapffe and Charles L. Faust, metallurgist and chemical engineer, respectively, Battelle Memorial Institute, Columbus, Ohio, have been presented the 1940 Proctor Memorial Award of the American Electroplaters' Society. The award, which carries a hundred-dollar stipend, is given for the best technical dissertation presented

Carl A. Zapffe

before the Educational Session of the Society at its annual meeting. The prize-winning paper, "Metallurgical Aspects of Hydrogen in Electroplating," was based on studies carried out in the Battelle laboratories. Dr. Zapffe and Dr. Faust demonstrated that absorbed hydrogen in the base metal can cause such common defects in electroplated coatings as blistering, peeling, cracking, and poor adherence.

Charles L. Faust

GLASS EXHIBIT, DEPARTMENT OF COMMERCE

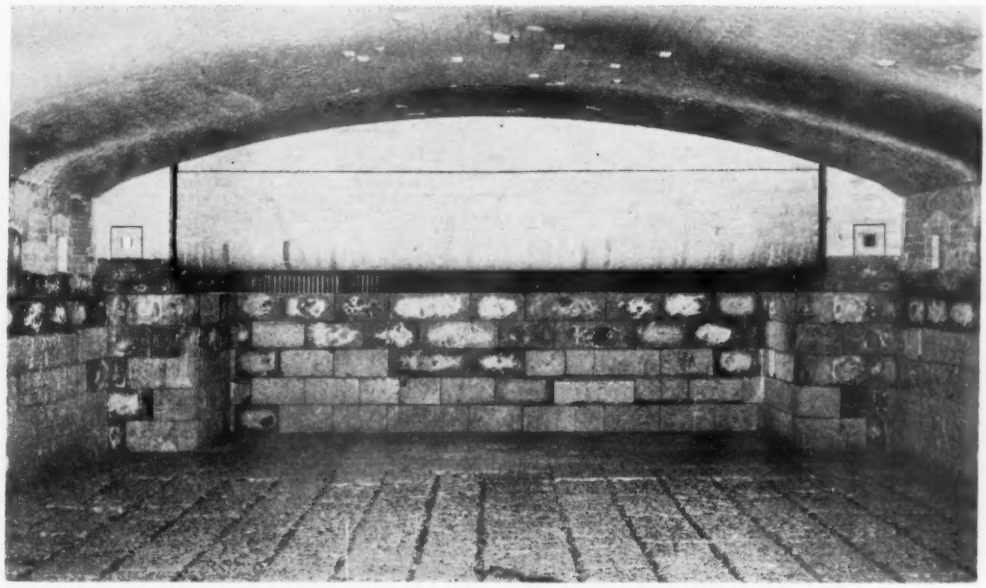
A glass exhibit now on display in the lobby of the Department of Commerce demonstrates the progress that the glass industry of the United States has made in the development and improvement of its products.

Redesigned glass containers, cooking utensils, laboratory and scientific ware, glass piping, glass brick, architectural glass, heat-treated plate glass, glass chalkboard, and a wide range of fibrous glass are shown in the display.

The cooking utensils can be used directly over a flame, such as coffee pots, double boilers, and frying pans. The laboratory and industrial ware is made of the new "Vycor" glass, which has necessitated a radical departure from conventional glass practice, resulting in a product which is 96% silica and which withstands greater temperatures than ever before.

Draperies, lamp wicks, glass-wool insulation, wire covering, battery mats, glass hats, and ties are of particular interest among the fibrous glass products.

The exhibit was made in cooperation with the Glass Container Association of America.



What you are looking for is here—

A SUSPENDED BACKWALL AND COVERED DOGHOUSE FOR YOUR TANKS

The results you can expect from SIMPLEX design are:

Reduces dust at the charging end.

Reduces cost of mantel block replacement.

Causes batch to frit before being exposed to flame.

Eliminates large percentage of dust and prolongs life and efficiency of checkers.

Gives greater flame coverage which produces more efficient melting.

Increases life of refractories in upper structure due to less dusting.

Gives better control of the foam line.

Melts same tonnage with less fuel than is possible with conventional method of filling.

SIMPLEX equipment always gives great satisfaction.

FRAZIER-SIMPLEX, INC.

ENGINEERS

435 EAST BEAU STREET • WASHINGTON, PENNA., U. S. A.

Abrasives
Carborundum Co. (*Carborundum and Aloxite*)
Celo Mines, Inc. (*Almanite Garnet*)
The Hommel Co., O., Inc.
Norton Co. (*Alundum-Crystolon*)

Air Conditioning Systems
Frazier-Simplex, Inc.

Aloxite (Refractory Products)
Carborundum Co.

Alumina (Hydrate and Calcined)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Alumina (Fused) Brick and Tile
The Vitro Mfg. Co.

Aluminum Oxide (Calcine)
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Aluminum Oxide (Fused)
Carborundum Co.
Harshaw Chemical Co.
Norton Co.
The Vitro Mfg. Co.

Alundum (Refractory Products)
Norton Co.

Ammonium Bicarbonate
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Solvay Sales Corp.

Ammonium Bifluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Ammonium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Antimony Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Antimony Sulphide
Edgar Plastic Kaolin Co.
Foote Mineral Co.
The Hommel Co., O., Inc.

Arches (Interlocking, Suspending, and Circular)
Frazier-Simplex, Inc.

Arsenic
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.

Automatic Brick Car Loaders
Lancaster Iron Works, Inc.

Ball Mills
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
McDanel Refractory Porcelain Co.
The Vitro Mfg. Co.

Ball Mills (Laboratory Type)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Barium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Basic Oxides
Porcelain Enamel and Mfg. Co.

Batch Systems
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Batts
Carborundum Co. (*"Carbofrax Aloxite"*)
Denver Fire Clay Co.
Norton Co. (*Alundum-Crystolon*)

Beryl
Foote Mineral Co.

Bichromate of Soda
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Bitstone
Potters Supply Co.

Blocks (Refractory)
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Louthan Mfg. Co.
Norton Co.
The Vitro Mfg. Co.

Body Stains
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Bone Ash
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Borax
American Potash & Chemical Corp.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Borax Glass
American Potash & Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Anhydrous)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. (*"Carbofrax Aloxite"*)
Corhart Refractories Co.
Denver Fire Clay Co.
Norton Co.
The Vitro Mfg. Co.

Cadmium Sulphide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

Castings (Abrasive Resisting)
Bethlehem Steel Co.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Solvay Sales Corp.

Caustic Soda
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Cements
Carborundum Co.
Corhart Refractories Co.
Norton Co.
Pennsylvania Salt Mfg. Co.

Ceramic Chemicals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cerium Oxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.

Chromium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Ball)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay (Bentonite)
Edgar Plastic Kaolin Co.
Great Lakes Foundry Sand Co.

Clay (Block)
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Clay (China)
Ceramic Color & Chemical Mfg. Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Thomas Alabama Kaolin Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

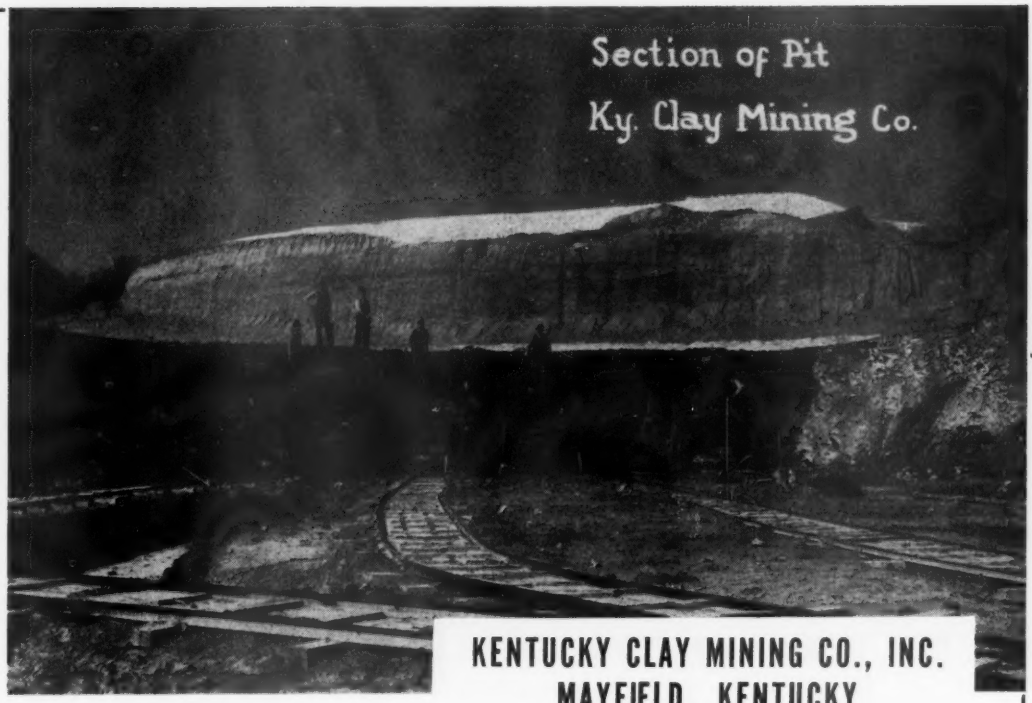
Clay (Electrical, Porcelain)
Ceramic Color & Chemical Mfg. Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Enamel)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Metal & Thermit Corp.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
The Vitro Mfg. Co.
United Clay Mines Corp.

Clay (Fire)
Denver Fire Clay Co.
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (German Vallendar)
Ceramic Color & Chemical Mfg. Co.

QUALITY BALL CLAYS



KENTUCKY CLAY MINING CO., INC.
MAYFIELD, KENTUCKY
V. J. Roehm, Alliance, Ohio

. . Produce Better Ware . .

Eastern Sales Representative
Enterprise White Clay Co.
Philadelphia, Pa.

Western Sales Representative
Mineral Products Company
Huntington Park, Calif.

THE HOUSE OF HOMMEL
SUPPLIERS OF ALL CERAMIC NEEDS

Quality
FRITS
COLORS
CHEMICALS
Stocked for
IMMEDIATE
SHIPMENT

THE
O. HOMMEL CO.
Quality First - Since 1891
209 Fourth Avenue Pittsburgh, Pa.
LET OTHERS IMITATE :: WE ORIGINATE

Pacific Coast Agents
L. H. BUTCHER CO.
Los Angeles - Salt Lake City - San Francisco - Portland - Seattle

JOURNAL OF THE SOCIETY OF GLASS TECHNOLOGY

A bimonthly Journal containing the original papers communicated to the Society together with abstracts of other papers covering the whole field of glass technology.

Membership of the Society is open to all persons, or associations of persons, interested in glass.

Orders and enquiries should be addressed to—

The Secretary,
Society of Glass Technology,
The University,
"Elmfield," Northumberland Road,
SHEFFIELD, 10, England.

GIVE YOUR GLAZE A FACIAL

To put a smoother complexion on your glaze~ for a higher gloss and the elimination of pin-holes~we suggest Foote's Lithium Carbonate ~a small percentage has "lifted the face" of many glazes.

Foote Mineral Co.
1605 Summer St., Philadelphia, Pa.

THE WASHING PLANT OF THE GOVERNMENT CERAMIC INDUSTRIES TRAVANCORE, INDIA

We produce!
FINE CERAMIC CLAYS FOR
TEXTILES PAPER POTTERY

We manufacture!
PORCELAIN STONEWARE
ELECTRIC INSULATORS
REFRACTORIES FIRE-BRICKS
AND
DRAINAGE PIPES

Government Ceramic Industries
Kundara, Travancore, India

Ceramic Service? We Give It

We Manufacture—
Pins—all shapes and lengths
Stilts
Thimbles
Spurs
Saggers
Crucibles
Tile for Decorating Kilns

We Sell—
Ball Clays—Kentucky
Sagger Clays—Kentucky
Ground Fire Clay—Ohio, Pennsylvania
Bitstone—all sizes
Fire Brick
Imported Paris White
Domestic Whiting
Georgia Kaolin
Modeling Clay

THE POTTERS SUPPLY COMPANY
EAST LIVERPOOL, OHIO

See Strains in Glass with the B&L POLARISCOPE

FREQUENTLY you can easily correct conditions that cause strain in your glass products through application of the information furnished by a B&L Polariscope. It makes it possible to actually *see* strains and to estimate degree of strain.

A new high-intensity illuminating unit and improved optics adapt the B&L Polariscope to the most exacting work and make it possible to examine and check transparent, frosted or colored glass objects. A large operating and mechanical field permits inspection of large bodies up to 15″ diameter at a glance. No special skill is required in its operation.

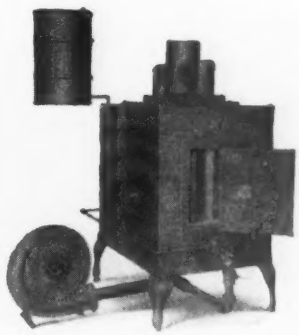
The Ring Test Microscope

The B&L Ring Test Microscope reveals strain in cross sections in many cases where the Polariscope has shown no strain existed. To complete your inspection process you need this valuable instrument. Complete details are available.

For further information on either of the above instruments, write to Bausch & Lomb Optical Co., 654 St. Paul St., Rochester, N. Y.

BAUSCH & LOMB OPTICAL COMPANY

FOR YOUR EYES, INSIST ON BAUSCH & LOMB EYEWEAR, MADE FROM BAUSCH & LOMB GLASS TO BAUSCH & LOMB HIGH STANDARDS OF PRECISION



BIGGEST KILN *IMPROVEMENT* OF A DECADE!

After months of development and laboratory and field testing, we announce "Hi-K" Tubes .... now standard equipment in all KERAMIC KILNS.

"Hi-K" Tubes (Higher Thermal Conductivity) reduce heating time and fuel consumption approximately 20%! They have thinner walls, yet outlast fireclay tubes about 2-to-1.

Just another big reason why you should standardize on **KERAMIC KILNS.** For others, ask for *Bulletin 361*. Complete data.

The **DENVER FIRE CLAY** Company

EL PASO, TEXAS
NEW YORK, N.Y.
DFC
SALT LAKE CITY, UTAH

DENVER, COLO., U.S.A.

FORTY-THIRD ANNUAL MEETING, AMERICAN CERAMIC SOCIETY

BALTIMORE, MARYLAND, MARCH 30 to APRIL 5, 1941

BALTIMORE HOTELS

The true test of a meeting city is not only the number of its hotels but their quality. Baltimore, with a tradition of hospitality founded on good food and good service, enjoys an established reputation in accommodating visitors to the city and making them feel at home. A reputation for the enjoyment of living has made Baltimore a haven for travelers. Baltimore has several consistently good hotels. The larger hotels are all located within a radius of a few blocks.

If you have ever been a visitor to Baltimore, you probably will recall with pleasure one of the following, a few of Baltimore's sixty hotels:

Lord Baltimore	Mt. Royal
Emerson	New Howard
Southern	Arundel
Belvedere	Stafford
Rennert	Congress

Altamont

ENTERTAINMENT AND RECREATION IN BALTIMORE

With (1) its rich historical background, (2) diversified industrial and world-wide commercial activity, (3) cultural and educational attainments, and (4) proximity to the Nation's Capitol, to picturesque and colonial Annapolis, home of the U. S. Naval Academy, and the near-by Chesapeake Bay, aptly described as the "Little Mediterranean of America," offering exceptional and almost unlimited post-Meeting recreational opportunities, Baltimore is truly one of America's most interesting, complete, and diversified meeting cities.

BALTIMORE, MARYLAND, CLIMATE

Baltimore's temperate climatic conditions are favorable for meetings at any time of the year as shown by the following mean temperatures based on figures compiled by the United States Weather Bureau over a long period of time:

Winter	35.5 degrees	Spring	53.4 degrees
Summer	75.1 degrees	Fall	57.7 degrees

The Best West of the Rockies

- **POTTERY CLAYS**
  English and American
- **CERAMIC COLORS**
  Blythe Colour Works, Ltd.
- **SLABS...SETTERS...SAGGERS**
  New Castle Refractories Co.
- **STANDARD PYROMETRIC CONES**
  Edward Orton, Jr., Ceramic Foundation
- **FRANTZ FERROFILTERS**
- **LAKEFIELD NEPHELINE SYENITE**
  Great Lakes Foundry Sand Co.

ELWYN L. MAXSON

112 W. 9TH ST. *Ceramic Materials* LOS ANGELES

PAPER MAKERS IMPORTING CO. INC. EASTON, PENNSYLVANIA, U.S.A. PMI INC

HIGHEST QUALITY
IMPORTED AND DOMESTIC

CLAYS

FLINT TALC

WHITING

PRECIPITATED CALCIUM CARBONATE

Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Kentucky Clay Mining Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Clay (Micronized)
Porcelain Enamel and Mfg. Co.

Clay Miners
Edgar Plastic Kaolin Co.
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Potters)
Denver Fire Clay Co.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay (Process Equipment)
Lancaster Iron Works, Inc.
National Engineering Co.

Clay (Sagger)
Edgar Plastic Kaolin Co.
Great Lakes Foundry Sand Co.
The Hommel Co., O., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Clay-Slip (Albany)
Hammill & Gillespie, Inc.
United Clay Mines Corp.

Clay (Wad)
Kentucky Clay Mining Co.
Potters Supply Co.
Spinks, H. C., Clay Co.
Thomas Albama Kaolin Co.
United Clay Mines Corp.

Clay (Wall Tile)
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Paper Makers Importing Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.

Cleaners
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.

Cleaners, Chemical
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.

Clocks (Gauge Board)
The Hommel Co., O., Inc.

Cobalt Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cobalt Sulphate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Colors
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Cones
The Edward Orton, Jr., Ceramic Foundation

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Copper Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Denver Fire Clay Co.
Norton Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Decorating Supplies
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.
National Engineering Co.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Porcelain Enamel and Mfg. Co.

Enameling Equipment (Complete)
Ceramic Color & Chemical Mfg. Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.
Bethlehem Steel Co.

Enameling Muffles
Bethlehem Steel Co.
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamels
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Enamels (Porcelain)
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
Ceramic Color & Chemical Mfg. Co.
The DeVilbiss Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.

Exhaust Systems
The DeVilbiss Co.

Feldspar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Denver Fire Clay Co.
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.
Thomas Alabama Kaolin Co.

Flint
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.

Flint Pebbles
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
The Hommel Co., O., Inc.

French Flint
Maxson, Elwyn L.
Paper Makers Importing Co.

Frit
Ceramic Color & Chemical Mfg. Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Fuel Oil Systems and Control, Stokers
Bethlehem Steel Co.
Frazier-Simplex, Inc.

Furnaces
Carborundum Co. (*Carboradiant*)
Denver Fire Clay Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Swindell-Dressler Corp.

Furnaces, Enameling
Swindell-Dressler Corp.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Hartford-Empire Co.
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glazes and Enamels
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.

THE SHARP-SCHURTZ COMPANY

CHEMISTS FOR THE CERAMIC INDUSTRY

WE HAVE FULLY EQUIPPED LABORATORIES AT

LANCASTER, OHIO U. S. A.

EMERSON P. POSTE

CONSULTING CHEMICAL ENGINEER

ANALYSES: CERAMIC RAW MATERIALS AND PRODUCTS, FUELS, IRON AND STEEL, ETC.

SPECIAL INVESTIGATIONS: PHYSICAL AND CHEMICAL TESTS ON ENAMEL, ETC.

309 McCALLIE AVE., CHATTANOOGA, TENN.

CERAMITALC

REGISTERED IN U. S. PATENT OFFICE

SPECIAL TALC for CERAMIC BODIES

INTERNATIONAL PULP CO.

41 PARK ROW LIBERAL SAMPLES FREE NEW YORK

All Types of Circular and Straight Tunnel Kilns

SWINDELL-DRESSLER CORPORATION

Post Office Box 1888 **Pittsburgh, Pa.**

Lehrs and Enameling Furnaces, Electric and Gas Fired

Full Details Furnished on Request

KILN ROOM REQUISITES OF

Ceramic Specialists SINCE 1901

DINNERWARE SETTERS & RINGS
TILE SETTER PINS
THIMBLES
FIRING RACKS
PINS • STILTS • SPURS
SPECIALTIES

LOUTHAN HI-FIRE *Refractories*

THE LOUTHAN MANUFACTURING COMPANY

NEW YORK EAST LIVERPOOL, OHIO, U. S. A. LOS ANGELES

INDUSTRIAL CERAMIC PRODUCTS, Inc.

MANUFACTURERS

PINS COLUMBUS, OHIO STILTS

Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.

Goggles
The Hommel Co., O., Inc.

Gold
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Granulators
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Chicago Vitreous Enamel Product Co.
Norton Co. (*Alundum-Crystolon*)

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Norton Co. (*Crystolon*)

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

Hose (Air and Fluid)
The DeVilbiss Co.

Hydrofluoric Acid
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Iron Chromite
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.

Iron (Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Iron Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Kaolin
Ceramic Color & Chemical Mfg. Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
Thomas Alabama Kaolin Co.
United Clay Mines Corp.
The Vitro Mfg. Co.

Kilns, China (Decorating)
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Frazier-Simplex, Inc.
The Hommel Co., O., Inc.
Swindell-Dressler Corp.

Kilns-(Electric, Circular, Tunnel)
Swindell-Dressler Corp.

Kiln Furniture (Silicon Carbide, Semi-Silicon carbide) (Refractory)
Louthan Mfg. Co.

Kyanite
Celo Mines, Inc.

Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.

Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.
The Vitro Mfg. Co.

Lithium Carbonate
Drakenfeld, B. F., & Co.
Edgar Plastic Kaolin Co.
Foote Mineral Co.

Lithium Minerals
Foote Mineral Co.

Loaders (Bucket)
National Engineering Co.

Magnesia (Fused)
Norton Co.

Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Porcelain Enamel and Mfg. Co.

Magnesite
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Magnesite Calcined
Foote Mineral Co.
The Hommel Co., O., Inc.

Magnesium Carbonate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Manganese
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Edgar Plastic Kaolin Co.
Foote Mineral Co.

Manganese (Oxide)
Ceramic Color & Chemical Mfg. Co.
Cornart Refractories Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Masks (Breathing)
The DeVilbiss Co.
Drakenfeld, B. F., & Co.

Metals (Porcelain Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Micronized Products
Porcelain Enamel and Mfg. Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Microscopes (Stereoscopic)
Spencer Lens Co.

Minerals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Mixers
National Engineering Co.

Mixers (Batch)
Lancaster Iron Works, Inc.
National Engineering Co.

Mixers (Concrete, Paving, Road Paving, Plaster, Asphalt, Truck, Mortar, Bituminous)
Lancaster Iron Works, Inc.

Mixers (Laboratory)
Lancaster Iron Works, Inc.
National Engineering Co.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace) (Laboratory)
Carborundum Co. (*Carbofrax*)
Denver Fire Clay Co.
Frazier-Simplex, Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.

Mullers (Batch)
Lancaster Iron Works, Inc.
National Engineering Co.

Muriatic Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.

Needle Antimony
Edgar Plastic Kaolin Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Nepheline Syenite
Great Lakes Foundry Sand Co.

Nickel Salts
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Nitre
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Opacifiers
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Overglaze Colors
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Oxides
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Palladium Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Pins
The Hommel Co., O., Inc.
Industrial Ceramic Products, Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Louthan Mfg. Co.
Potters Supply Co.

Pins (Tile Setter)
Louthan Mfg. Co.

Placing Sand
Great Lakes Foundry Sand Co.
United Clay Mines Corp.

Platinum Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.

Polariscopes
Bausch & Lomb Optical Co.
Frazier-Simplex, Inc.

Porcelain Enameling Service (Practical)
American Rolling Mill Co.
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Porcelain Enamels
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Potters Wheels
Denver Fire Clay Co.

Potash (Carbonate)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.

"Ceramic"
Colors
AND
Chemicals

WENNING CERAMIC COLORS TRADE MARK

for POTTERY
· GLASS
· ENAMEL

See our catalog in Ceramic Data Book

CERAMIC COLOR AND CHEMICAL MFG. CO.
New Brighton, Pa., U. S. A.

Bethlehem Products for the Ceramic Industry

88-80 CASTINGS
to save maintenance on grinding equipment

BETHLEHEM ABRASIVE-RESISTING PLATES
for chutes, hoppers, dump-car bottoms

BETHLEHEM TOOL STEEL
for dry press and repress liners

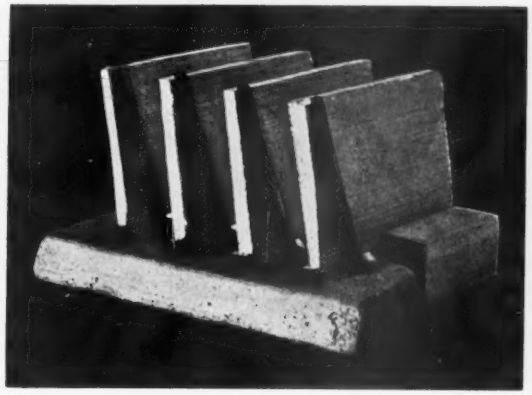
BETH-CO-LOY SHEETS
for long-lasting roofing and siding

WIRE ROPE
for all excavating and material-handling equipment

Also—Light Rails, Steel Ties and Track Equipment, Steel Pipe

BETHLEHEM STEEL COMPANY
General Offices BETHLEHEM STEEL **Bethlehem, Pa.**

ORTON STANDARD PYROMETRIC CONES



Jig for setting cones to deform at right angles to the observer

The physical properties of clay wares are materially affected by different firing treatments even though the final temperature is the same.

Pyrometric cones placed at various points in the setting and visible from peepholes will provide the most satisfactory means for determining the heat distribution in the kiln at all stages of the firing process above 1100° F and are especially useful at the end of the heating treatment.

The composition of the pyrometric cones is similar to the composition of clay bodies. The reactions involved by heating are similar and in the case of the cones, a deformation anticipates the deformation of the ware in the kiln because the pyrometric cones are softer, as a general rule, than the wares which are being fired.

California Representative	South American Representative
E. L. Maxson 112 W. 9th St. Los Angeles, Calif.	The Ferro Enamel Corp. 4150 E. 56th St. Cleveland, Ohio

THE EDWARD ORTON, JR., CERAMIC FOUNDATION
1445 SUMMIT STREET COLUMBUS, OHIO

The Hommel Co., O., Inc.
Solvay Sales Corp.
The Vitro Mfg. Co.

Producer Glass Plants
Frazier-Simplex, Inc.

Pug Mills
Lancaster Iron Works, Inc.

Pyrites (Natural Iron Sulphide)
Foote Mineral Co.
The Hommel Co., O., Inc.

Pyrometer Tubes
Carborundum Co.
Montgomery Porcelain Products Co.

Pyrometer Tubes (Refractory and Hard Porcelain)
Denver Fire Clay Co.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

Pyrometers (Optical, Radiation, Surface, Immersion, Needle)
Leeds & Northrup Co.
Pyrometer Instrument Co.

Pyrometric Cones
The Edward Orton, Jr., Ceramic Foundation

Racks, Firing (Refractory)
Louthan Mfg. Co.

Raw Material Handling Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Refractometers
Bausch & Lomb Optical Co.
Spencer Lens Co.

Refractories
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Louthan Mfg. Co.
Norton Co.

Refractory Materials
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Louthan Mfg. Co.
Norton Co.
Thomas Alabama Kaolin Co.

Respirators
The DeVilbiss Co.
Drakenfeld, B. F., & Co.
The Hommel Co., O., Inc.

Rutile
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Edgar Plastic Kaolin Co.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Saggers
Carborundum Co.
Norton Co.
Potters Supply Co.

Salt Case
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.

Sandblast Sand
Great Lakes Foundry Sand Co.

Sand Grinder and Sifters
Lancaster Iron Works, Inc.

Saponin
The Hommel Co., O., Inc.

Screening and Magnetic Separators
National Engineering Co.

Selenite of Sodium
Drakenfeld, B. F., & Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Selenium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Setters (Tableware)
Louthan Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.
Bethlehem Steel Co.

Silica (Fused)
Edgar Plastic Kaolin Co.
The Hommel Co., O., Inc.

Silicate of Soda
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Silicon Carbide
Carborundum Co.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Denver Fire Clay Co.

Slabs (Furnace)
Carborundum Co.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.

Soda Ash
American Potash & Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Sodium Antimonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Sodium Fluoride
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.

Sodium Nitrite
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Sodium Silica Fluoride
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Sodium Uranate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Maxson, Elwyn L.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Spray Booths
The DeVilbiss Co.
The Hommel Co., O., Inc.

Spraying Equipment
The DeVilbiss Co.
The Hommel Co., O., Inc.

Spurs
Louthan Mfg. Co.
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Stilts
The Hommel Co., O., Inc.
Industrial Ceramic Products, Inc.
Louthan Mfg. Co.
Potters Supply Co.

Sulfuric Acid
Denver Fire Clay Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Pennsylvania Salt Mfg. Co.

Talc
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
International Pulp Co.
Paper Makers Importing Co.

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Corhart Refractories Co.

Tanks (Pickle)
The Hommel Co., O., Inc.

Tanks for Raw Material Steel or Concrete
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Norton Co.

Tile Setter Pins
Louthan Mfg. Co.

Tile (Refractory)
Carborundum Co. (*Carbofrax*)
Denver Fire Clay Co.
Norton Co.
Thomas Alabama Kaolin Co.

Tile (Wall)
Denver Fire Clay Co.
Thomas Alabama Kaolin Co.

Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Titanium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Trisodium Phosphate
Harshaw Chemical Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
Louthan Mfg. Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Denver Fire Clay Co.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

Uranium Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel Co., O., Inc.

Uranium Oxide (Yellow-Orange-Black)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Wet Enamel
Ceramic Color & Chemical Mfg. Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Whiting
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Zircon
Edgar Plastic Kaolin Co.
Foote Mineral Co.
The Hommel Co., O., Inc.

Zirconia
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Harshaw Chemical Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Zirconium Oxide
Foote Mineral Co.
The Hommel Co., O., Inc.
Titanium Alloy Mfg. Co.

Zirkite (Natural ZrO_2)
Foote Mineral Co.

for Permanent—Colorful

DECORATIVE LABELS on BOTTLES AND GLASS CONTAINERS

DU PONT
REG. U. S. PAT. OFF.

Resistant Colors

withstand Severe Service

IT TOOK years of extensive research to develop these Resistant Colors . . . to make certain that they met the severe service requirements for applied color labels on beverage bottles and other glass containers.

The present line of improved colors are now standard materials in most of the plants doing applied color label decorating because they are:

★ *Alkali-Resistant*—Repeated exposure to hot caustic solutions prove the superiority of these colors, their ability to stand up under drastic treatment.

★ *Acid-Resistant*—Extremely high—something once considered impossible to obtain jointly with high alkali resistance.

★ *Strain-Free*—Perfect matching of expansion coefficient with those of commercial bottle glass assures absence of strain or breakage troubles from these applied colors.

★ *Easily Applied*—Smooth, even color applications of exceptionally high gloss—easily adapted to the heaviest of multi-layer designs—can be obtained without the troubles usually associated with heavy applications.

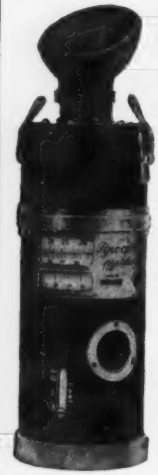
No other colors can offer this combination of advantages which are so essential for the satisfactory performance of a decorated container. And with them is offered du Pont technical service, experienced men to assist in solving problems in applied color label decoration and in the working out of the most efficient production set-up possible for the individual shop. This service is offered you without obligation—we invite you to call on us.

★ ★ ★

Visit the du Pont Wonder World of Chemistry Exhibits at the New York World's Fair and on the Boardwalk at Atlantic City.

DU PONT
REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
The R. & H. Chemicals Department
Ceramics Division Wilmington, Delaware
District Sales Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, Newark, New York, Philadelphia, Pittsburgh, San Francisco



PYRO THE SIMPLIFIED OPTICAL PYROMETER

YOU cannot afford NOT to own one!

BECAUSE it eliminates guesswork, waste and spoilage; it pays for itself quickly. PYRO is a SELF-CONTAINED, DIRECT-READING, STURDY unit made to stand rough use but it is absolutely accurate and dependable.

Unique construction enables operator to rapidly determine temperature even on minute spots, fast moving objects or the smallest streams; no correction charts, no accessories, no upkeep.

PYRO RADIATION-PYROMETER

Ideal for furnace or kiln use. Gives actual heat of material aside from furnace or kiln temperature. Does not require skilled operator. Write for special bulletins.

THE PYROMETER INSTRUMENT CO.
105–109 Lafayette St. New York, N. Y.

WANTED: Ceramic engineer for research and development. Technical graduate preferably two years' plant production experience, refractories, or white wares. Opportunity to advance toward plant management. Give education, experience and references. Address Box 187F, American Ceramic Society, 2525 North High St., Columbus, Ohio.

COMPLETE MEMBERSHIP ROSTER

▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪

WILL BE PUBLISHED IN THE OCTOBER BULLETIN

This ROSTER will be the "Who's Who" of Ceramic Technology; therefore, the name of every ceramist should be listed.

Advertising will be especially effective in the October Bulletin because the circulation will be greatly increased and because this Roster will be referred to constantly.

Please write for advertising rates

AMERICAN CERAMIC SOCIETY
2525 N. HIGH ST. COLUMBUS, OHIO

KAMEC

THE SUPERIOR KAOLIN

ASSURED UNIFORMITY
AMPLE STOCK

DEPENDABLE RESERVES
PROMPT SHIPMENTS

You Are Invited To Visit Our Plant

KAOLIN, INCORPORATED

Main Office, Mine and Mill - SPRUCE PINE, N. C.

INDIANAPOLIS OFFICE - - - - 1511 W. WASHINGTON ST.

BORAX *Guaranteed 99½%–100% Pure* **BORIC ACID**

Select the Brand which has back of it years of *successful use* by experienced Ceramists

Pacific Coast Borax Co., New York

Chicago **Los Angeles**

BACK NUMBERS
OF
JOURNAL OF AMERICAN CERAMIC SOCIETY
AND ALL IMPORTANT MAGAZINES FROM THE WORLD OVER

We furnish single copies, volumes, or sets reasonably and promptly

WRITE, PHONE OR WIRE PERIODICALS DEPARTMENT

THE H. W. WILSON COMPANY 950 University Avenue, New York

"AT THE LOWEST POSSIBLE COST"

Keeping rates low, in the face of rising costs, has been one of the outstanding achievements of the Bell System.

This would not have been possible without efficiency all along the line, economies resulting from centralized research and manufacture, and a sincere desire to serve the best interests of the public.

BELL TELEPHONE SYSTEM

H. C. SPINKS CLAY COMPANY

Miners and Shippers of

BALL, SAGGER AND WAD CLAY

NEWPORT, KY.

Puryear, Tennessee
September 1, 1940

Mr. Pete Potter
Comfortable Sanitary Pottery Mfg. Co.
Pottsville, U. S. A.

Dear Pete:

Well, Pete, it must be Fall again. Only reason I can tell is the nights are cool enough so the niggers can eat watermelon and sing and dance and the boys have gone back to school to play football. Maybe they are going to study some, but they didn't say anything about it. Well anyhow, we will soon see if the Summer around these clay diggings has been a good thing for the running guard and the quarterback.

Speaking of quarterbacks, Pete. Don't you think maybe our boys over in Washington have their signals mixed up? Now I just read that Mr. Edward R. Noble, Undersecretary of Commerce, is helping some New York department store boys organize potteries and glass plants in Latin America with the aid of U. S. Government money. They say the idea is to build our southern neighbors up financially so they can buy lots of our guns and bullets.

Now Pete, I very definitely ain't in favor of giving those boys all those weapons 'til we are awfully sure whose team they are going to play on, and too, I am sort of scared that if we did get backed down against our own goal line those boys might open up holes in the wrong line. As for this Undersecretary Noble, my bet is that before the game is started good he will be found at the bottom of the pile with a few cleat marks on his face and some Latin will have the ball.

Maybe we better make a study of this between now and November.

Sincerely,

Dick Carothers

General Manager
H. C. SPINKS CLAY COMPANY

M and T TIN OXIDE

Brilliant . . . rich . . . snow-white . . . free of specks and discolorations . . . that's the kind of glaze you want, and that's the kind you will get consistently with M & T Tin Oxide.

Hundreds of important firms have standardized on the use of M & T Tin Oxide because it assures, at an advantageous price, the superior results they demand.

METAL & THERMIT CORPORATION

120 BROADWAY

NEW YORK